

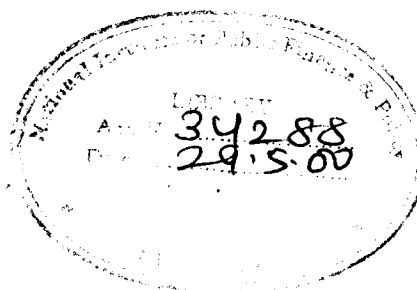
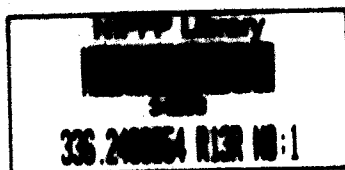
Report



# Design of a Land-Based Agricultural Presumptive Tax for Use by Panchayats

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Indira Rajaraman  
M.J. Bhende



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February 1998

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National Institute of Public Finance and Policy  
New Delhi

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## ***PREFACE***

This study was undertaken as part of a programme of Research on Taxation sponsored and funded by the UNDP under the Project on Policy Studies on Economic Reform. The work was done collaboratively by Dr. Indira Rajaraman of NIPFP, New Delhi (to which institute the study was entrusted) and Dr. M.J. Bhende of ISEC, Bangalore.

Direct taxation on a presumptive basis is being advocated and practised, fairly widely on efficiency grounds as well as for the purpose of taxing 'hard to tax' and small-scale or unorganised sectors. Land Revenue in India has been levied, historically, on a presumptive basis related to estimated average yield per hectare. The estimates were to be revised through periodic "settlements" which were quite complicated, elaborate and time-consuming. For this and other (political) reasons, revisions of land revenue have not been carried out for decades, and hence land revenue has ceased to be an effective means of raising resources from the agricultural sector.

The authors of this report propose a crop-specific presumptive land tax, which like the land revenue will be land-based and levied per acre. Their view is that the land revenue may also continue to be levied in its present form and the power to levy both should be vested in the Panchayats. The specification of crop-specific norms to be derived on the basis of field surveys proposed in the study is the major point of departure from the approaches to land taxation in India recommended hitherto. The requirement of crop specific norms leads to the need for phased, sequential implementation, with the initial focus on the crop/s known to be most profitable in each area. The report gives a detailed plan of implementation, starting from the District Planning Committees forwarding to the State government a list agricultural activities selected for initial survey, the conduct of field surveys by state level agencies and finally the levy of the taxes by the Panchayats. The implementation of this proposal will of necessity require field surveys to estimate "surplus" earned from the cultivation of the chosen crops.

The report presents the results of a field survey conducted in Northern Karnataka, covering three commercial crops, as a prototype of the kind of exercise necessary to develop presumptive norms. The field survey of the kind whose results are presented in the report is intended to generate for each crop two parameters, the threshold yield (in physical units) per acre and the surplus over total cost as a percentage of total revenue at the

threshold yield. The authors argue that these can be retained as constants for all future assessment years. Updating the absolute levy per acre to any future assessment year will require information only on the price of the crop in that year.

In the context of the desire and intention to entrust greater responsibilities to the Panchayats and increase the scope of their activities, there is a felt need to explore avenues for them to raise additional resources. The proposal put forward in this report for a crop-specific presumptive land tax as a supplement to land revenue, will therefore be of great interest to economists and policy makers. It is hoped that the logic of the proposal itself, its feasibility and implications will be widely discussed.

The Governing Body of the Institute does not bear responsibility for the contents of this report or the views expressed.

New Delhi  
February 1998

Raja J. Chelliah  
Chairman, NIPFP

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Suggestions on an earlier draft were received from Dr. V. M. Rao of ISEC, Dr. Richard Bird of the University of Toronto and Dr. Alex Winter-Nelson of the University of Illinois, Urbana-Champaign. We thank them, and exonerate them of all responsibility for surviving errors.

Mr. Vishwanath Reddy and Mr. Vishwanath, Joint Directors, Land Records Office, Government of Karnataka and Mr. Satyanarayana, Shirestedar, Bangalore South Taluk Office patiently answered our many questions about the structure of land revenue rates. Other officials who enlightened us on taxation of agriculture in the State were Mr. Sudhir Krishna, Commissioner, and Mr. Y.D. Vijaykumar, Joint Commissioner, Commercial Taxes, and Mr. Shirol, Deputy Secretary, Panchayati Raj of the Government of Karnataka.

The field interviews were performed by Mr. J.H. Paramesha and Mr. S. Manohar Rao. The field study itself would have been impossible without the kind assistance of Mr. S.L. Hiregouder and the late Dr. H.G. Shankaramurthy. Anu Bhayana transcribed the data and Deepa Sankar assisted with the literature review.

Most of all, we are grateful to the farmers who generously spared their time for us and patiently responded to the many questions we put to them.

Mrs. Promila Rajvanshi word processed several drafts of the report cheerfully, accurately and quickly. We owe her a special debt of gratitude.

Indira Rajaraman  
M.J. Bhende

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## **EXECUTIVE SUMMARY**

This report proposes, and provides the design for, a crop-specific presumptive supplement to the land revenue, which like the land revenue will be land-based and levied per acre. The supplementary levy is to be related on the basis of income norms obtained from field surveys to observed crop yields, which will serve as the presumptive indicator. The case for a crop-specific levy is predicated on the assumption that returns to cultivation are not equalised by cropping pattern shifts, even within a homogenous agro-climatic region, because of supply-side entry barriers in terms of soil and irrigation requirements, and further entry barriers imposed by the need for bilateral tie-ups between cultivator and buyer in sunrise sectors like seed propagation.

The design for the levy proposed includes exemption for crop failure, whether idiosyncratic or non-idiosyncratic, in the form of a threshold yield below which the tax does not apply. A simple single-rate structure is recommended, worked out for net income at the threshold yield, so that no information is required on the exact quantum of yields above the threshold. The only information required for each assessment year is a listing of cultivators growing any of the crops in the subset selected for taxation, and an identification of those in each list whose yields did not fall below the stipulated exemption threshold. Such information will be easily and costlessly obtainable locally, which is why levies of this type are feasible only at panchayat level. The Agricultural Holdings Tax (AHT) of the Raj Committee by contrast required information for each assessment year on the complete cropping pattern of every cultivator. This was among the reasons for the rejection of the AHT, other shortcomings of which included the absence of any systematic exemption provision for idiosyncratic crop failure, as distinct from non-idiosyncratic crop failure covering an entire region. No progression is recommended here in the rate structure by acreage sown to crops in the taxable subset, unlike the AHT which recommended progressivity by holding size. There will be a flat crop-specific rate per acre.

Any viable tax on non-plantation agriculture can only be presumptive, since the lack of standard account-keeping and the prevalence of cash transactions make verification of self declaration impossible. Even for plantation agriculture, on which there is a State-level agricultural income tax, some States currently offer a presumptive option to conventional taxation based on self-declaration. The land revenue over much of the country is also

presumptive in conception, although the relationship between levy and land productivity is seriously lagged and inadequately stratified. Thus, presumption in the agriculture context is not unknown in either principle or practice.

The report presents the results of a field survey conducted in Northern Karnataka, covering three commercial crops, as a prototype of the kind of exercise necessary to develop presumptive norms. The survey shows wide variations in net income between the three crops. Plots of the surplus over total variable cost as a percentage of total revenue show for two of the three crops a distinct threshold yield beyond which the percentage stabilises. If no such stability obtains between cost and revenue over any range of observed yields, the crop/activity is not taxable on a presumptive basis. Thus there is a fortunate convergence between the requirement of stable norms for presumptive purposes, and the requirement of a taxable threshold for equity purposes. The operational advantage of a taxable yield level defined at the point at which cross-sectional stability obtains is that it is independent of yield averages and therefore does not need redefinition from year to year.

The field survey is required to generate for each crop two parameters, the threshold yield  $Y$ , specified in physical units per acre (or other land unit), and the surplus over total cost as a percentage of total revenue at the threshold yield  $f_y$ . These can be retained as constants for all future assessment years. Updating the absolute levy per acre to any future assessment year will require information only on the price of the crop in that year.

The survey conducted here shows considerable room for additional taxation over and above the land revenue. For two of the three crops, land revenue at its maximum, inclusive of all cesses, constitutes well under half of 1% of net income of the cultivator. Three rates are suggested for the crop-specific levy, to be applied to net income at the threshold yield: 0.5%, 1% and 5%. The report does not suggest any revision of the basic land revenue, and only recommends that where it has been repealed (as in Haryana and Punjab) it should be restored, and that powers of levy should be transferred to panchayats, along with powers to levy the crop-specific supplementary levy. However, land records must remain in the hands of a State government functionary, to guard against corruption of land records by local power structures, as has repeatedly happened historically in India.

Panchayats do not have the technical expertise for conducting the field surveys, which can only be conducted by a State-level agency. But it is expected that the list of crops for consideration will first be identified by panchayats in accordance with the local ordering in terms of profitability, and forwarded to the State-level agency, which will define the taxable subset based on survey data. The revenues raised from both the land revenue and the crop-specific supplement should be jurisdictionally retained for improvement of agricultural and other infrastructure. This will facilitate compliance, give panchayats a stake in enforcement, and enable downward accountability in place of the upward accountability ensured by present systems of audit and control of government expenditure. There cannot be any national uniformity in the crops chosen for taxation nor indeed should such uniformity be sought. The tax is intended to enable public provision of productivity enhancing improvements to agricultural infrastructure, so that failure to implement the tax can only be a local decision with implications that, in the first instance, will be local rather than national.

The ultimate intent of the presumptive tax on agriculture proposed in this report is to strengthen the panchayat level of governance, and thereby make possible effective delivery of the many critical functions assigned to panchayats. Since the tax is grounded squarely on present-day yields, there is no danger that it will overestimate present-day ability to pay. Eventually, with agricultural income having been raised by the productive use of the initial tax revenues, rates of levy could be further enhanced for subsequent rounds of improvement to agricultural infrastructure.

# CHAPTER I

## INTRODUCTION

The power to tax agricultural income in India, under the Constitutional allocation of spheres of authority, is vested with State-level governments, separately from the power to tax non-agricultural income, which is vested with the Central government. This separation of powers of levy dates back to the pre-Independence Income Tax Act of 1935 under which Provincial Governments were granted the sole right to tax agricultural income. The exemption of agricultural income from the Central income tax continues under section 10(1) of the (presently operative) Income Tax Act of 1961.<sup>1</sup>

Two types of direct taxes on agriculture are found at State level. There is a land-based tax, called the land revenue. This has a long ancestry, and remains a universal levy (although some States like Haryana and Punjab more recently have abolished the land revenue). There is also a schedular agricultural income tax which is less universal, levied in only seven States (Assam, Bihar, Karnataka, Kerala, Orissa, Tamil Nadu and West Bengal),<sup>2</sup> and confined essentially to plantation crops.<sup>3</sup>

The combined yield from land revenue and the agricultural income tax amounted in 1994-95, the most recent year for which consolidated figures of actual collections across all States are available, to Rs. 1222 crores, of which land revenue accounted for over 90%.<sup>4</sup> The total amounted to a mere 0.8% of total national tax revenue aggregating across Centre and States; and 2.2 of tax revenues collected by the States. The common feature amidst the diversity of State-level land revenue legislation, which has reduced the levy to revenue insignificance over the years, is the long period between revisions of "settlement" rates as they are called. These remain statutorily fixed for a minimum of usually thirty years, and in practice often much longer. So low are these rates today, that they are to be seen more in the nature of user charges for the maintenance of land records by the village-level State government functionary appointed for revenue collection purposes.

On the need for taxing agricultural income in developing countries, there is overwhelming agreement among economists from the time of Ricardo.<sup>5</sup> The following quote

is representative, and is of considerable significance in juxtaposition against the revenue-insignificance of agricultural taxation in developing countries:

"Agricultural taxation is an important instrument of development policy simply because agriculture is important. As the largest economic sector in most developing countries, agriculture inevitably plays a key role in their economic and social development.....the tax system provides a major means of transferring resources out of agriculture - a task often considered essential to effective development policy, especially since some of the ways in which agriculture may be taxed may also have a desirable effect on the volume, composition, and disposition of agricultural income" (Bird, 1974: i).

The phrase "means of transferring resources out of agriculture" in the passage might explain the phobia attaching to agricultural taxation. Hence perhaps the reality that "not one developing country has to date utilized the undoubted potential of properly constructed agricultural taxes as part of a conscious development policy as well as to raise revenue" (Bird, 1974:41). Ursula Hicks has spoken of the "allergy of modern India to the effective taxation of the agricultural sector" (Hicks, 1961:330).

In the event, other non-transparent means of taxing agriculture were substituted, most usually the classic policy of import-protected industrialisation, which raises the price of industrial goods consumed by the agricultural sector well above world prices, while agricultural prices remain at (or below) world prices; and by restricting imports raises the exchange rate and thereby lowers the earnings in domestic currency from agricultural exports. This then leads to pressure for subsidised inputs for agriculture, and thus to the maze of price distortions the unravelling of which is the core of the typical programme for structural adjustment and reform in developing countries.

The correction of this complex interlocking of price distortions through which the agricultural sector is non-transparently taxed and simultaneously appeased cannot be smooth or instantaneous. During that process there must gradually be brought into place a transparent mechanism for taxing of agricultural incomes without, however, any of the historical insistence on the need for transferring resources out of agriculture. The new emphasis has to be on **retention** of any resources raised from agriculture for infrastructure development and productivity-enhancing land improvements **within the sector** (Newbery, 1992).

This report does not purport to provide a survey of the present design of land revenue in each State, nor of the methods used at each revision of settlement rates. What is important is that State governments have no interest in restructuring the levy to improve its buoyancy because land revenue is shared with panchayats, fully in some States, partially in others.<sup>6</sup>

Since land revenue has been shared in most States with panchayats, it has, at least in the post-Independence era, not been entirely a "means of transferring resources" out of the rural sector. However, this did not at the same time give panchayats a stake in improved collections, since the sharing of revenue was most usually not by origin (jurisdiction of collection) but by formula. The formula was most usually a uniform per capita sum, or some other such with redistributive intent. This left neither the panchayat nor the State government with a stake in improved collections. The land revenue in India is a textbook illustration of the folly of trying to achieve fiscal redistribution through tax sharing arrangements in place of independent and transparent grants.

Following the 73rd Amendment to the Constitution, which gave a Constitutional status to panchayats as a third tier in India's federal structure, new panchayat legislation has been enacted in almost all States. The fiscal provisions pertaining to panchayats under the new legislation are summarised elsewhere (Rajaraman et.al., 1996); these are enacted, but may not necessarily have been notified. The design of land revenue, and the general features of sharing provisions remain essentially unchanged under the new legislation, although there may have been some alterations of detail.<sup>7</sup>

Because the general difficulties of enforcing income tax compliance in developing countries are especially severe in the agriculture context, the design of a tax on agriculture cannot be examined independently of the level of government at which it is to be levied. For reasons which will be advanced and justified in this report, it is argued here that powers of levy of the land revenue should be further decentralised to the panchayat level of government.

This report further argues that the land revenue should be supplemented by a crop-specific presumptive levy, also land-based, but related on the basis of field surveys to crop yields by way of net income. Since field surveys are time-consuming, a supplementary levy

of this type can only be implemented in a sequential manner, with an initial focus on the crop/s known to be most profitable in each area. The technical expertise for conducting the field surveys will be available only at State level, so that there will have to be a process whereby the District Planning Committees<sup>8</sup> forward to the State government an initial list of agricultural activities for survey. Whichever among these proves to be taxable will then be the first to be implemented. Inter-crop equity is ensured by the two-stage procedure recommended here, whereby the selection of crops forwarded by the local bodies for consideration accords with the local ordering in terms of profitability, and the technical survey following defines a further subset based on objective evidence. There cannot be any national uniformity in the crops chosen for taxation nor indeed should such uniformity be sought. The purpose of such a tax is to enable public provision of productivity enhancing improvements to agricultural infrastructure, so that failure to implement the tax can only be a local decision with implications that, in the first instance, will be local rather than national.

Since this report does not recommend a nationally uniform land revenue, any recommendation can only be set in the context of a particular region. The region chosen for the exercise of devising crop-specific supplements to the land revenue is northern Karnataka.

It is necessary that the new crop-specific supplementary levies should be based on field surveys. To underline the importance of this, the report presents the results of a field survey conducted in northern Karnataka, covering three crops, as a prototype of the kind of exercise necessary. The relating of the crop-specific levy to yields on the basis of field evidence in this manner enables the prescription of a systematic catastrophe-exemption provision in the form of an endogenously-generated threshold yield, below which the cultivator will be exempt from having to pay the tax. This eliminates the risk element that land taxation introduces into net farmer income.<sup>9</sup> A simple single-rate structure is recommended in this report, not graded to yield levels above the threshold, so that no information is required on the exact quantum of yield of each taxable cultivator. No information is required either on the complete cropping pattern of every cultivator.

The only information required is a listing of cultivators growing any of the crops in the selected subset. This, and information on whether the yield obtained by a particular

cultivator falls above or below the stipulated exemption threshold will be easily and costlessly obtainable locally, which is why levies of this type are feasible only at panchayat level. The information costs which are advanced by Skinner, 1993, as a possible explanation of why land-based taxation of agriculture is rarely a serious revenue source despite its undoubted efficiency advantages (Skinner, 1993:352-373) can thus be seen to be quite simply a result of levy at the wrong level of government.

A land-based tax bears clearer jurisdictional markers than a tax on output or exports of the kind advanced by Hoff, 1991 and others, and is for that reason more suited to levy by local-level government. Since the incidence of an output tax falls in long-run competitive equilibrium on the consumers of agricultural products in proportion to their consumption, an output tax is more an indirect tax suited to levy by higher levels of government rather than a replacement in any sense for the within-sector generation of revenues that a well-designed land tax makes possible.

Transfer of powers of levy to panchayats and greater visibility of the uses to which tax revenues are put substitutes downward accountability for the upward accountability ensured by present systems of auditing and control of government expenditure. Transfer of powers of levy to panchayats need not necessarily be accompanied by transfer of the revenue collection function. Judgement on the relative revenue collection efficiency of different levels of government can only be empirically driven, and does not permit of resolution based on a priori arguments. There is already in place a State government administrative network for collection of land revenue, a network that can continue to be used if necessary until the panchayat administrative apparatus is suitably strengthened.

This report does not recommend independent powers of concurrent levy for State and panchayat level governments on agricultural income, because that leaves neither level of government with adequate control over the total tax burden imposed.

The association of agricultural taxation with oppression is a function of the historical experience of high rates of levy, coupled with an absence of systematic, as distinct from discretionary, catastrophe exemption. With reasonable rates of levy, systematic provision for catastrophe exemption, and with retention of revenues raised by local-level government, the compliance resistance to agricultural taxation should in principle be



possible to overcome. The following caveats should however be borne in mind:

1. Even where, as is recommended in this report, the power to levy agricultural taxes is given to the panchayat level of governance, the maintenance of land records must remain the rightful preserve of State governments. This is especially important in India where there are no formal titles to land ownership other than the land records maintained by the village-level official who is at present a State government functionary.<sup>10</sup> This arrangement will have to remain in place for the foreseeable future, so that local records are not corruptible by local power structures, as has repeatedly happened historically in India.
2. The devolution to panchayats of the power to levy land revenue must not imply the power not to levy land revenue in its present form. Land revenue must remain an obligatory tax levied at present rates at a minimum, so placing a floor on downside variability. Further, the structure of the present rate system should remain the same within a State, so that spatial variations in the minimum are a function only of variations in the basic levy. This leaves panchayats the freedom to levy additional crop-specific levies of the type recommended in this report.

The land-based levy recommended here is a presumptive levy on the income generated from the land rather than a levy on asset value in the sense of a property tax. To quote from Rajaraman, 1997:

"Presumption is an alternative to taxation based on self-declaration. There are three features that distinguish presumptive approaches:

1. Assessment of taxability independently of self-declaration.
2. The identification of objectively measurable indicators specific to each sector or economic activity and the use of these to establish not merely taxability, but also the taxable income generated per unit of the chosen indicator/s.
3. The need for robust survey-based norms linking taxable income to these observed indicators." (Rajaraman, 1997:1)

Although clearly characterised by regional diversity in terms of design and construction, land revenue as presently levied in most States is presumptive in conception, in that it is related in principle to average returns to the land. The actual relationship between levy and land productivity may be seriously lagged, inadequately stratified, or otherwise deficient, but the principle underlying the levy has always, historically and

presently, been the productivity of land, however that productivity might have been assessed.

A conventional income tax on agricultural income based on self-declaration supported by books of accounts is difficult in general, except in the context of large-scale organised operations like plantations. It is impossible in the context of small-scale farming in developing countries, because of the difficulties of verification and monitoring of large numbers of petty cash transactions. Because of this, some States like Karnataka, Kerala and Orissa for example offer presumptive options to the agricultural income tax, in the form of rates per hectare based on average income, in place of self-declared income actuals. Where this is done, the agricultural income tax functions essentially as a plantation crop-specific supplement of the type recommended in this report.

The case for supplementary levies on a selected subset of crops is predicated on the assumption that returns to cultivation are not equalised by cropping pattern shifts, even within a homogeneous agro-climatic region. Any of a number of barriers to entry, ranging from soil requirements to insufficiency of irrigation or credit can prevent factor shifts to the most profitable crop in a region. With the reform of the Indian economy starting in 1991, it is expected that new agro-based activities ranging from export of cut flowers to seed propagation will be the new "sunrise" sector in agriculture. These activities are likely to be especially entry-barriered because of the need for tie-ups with buyers, who tend to limit their engagement so as not to over reach their monitoring and quality control capabilities.

Dissatisfaction with the poor yield of agricultural taxation in India has been repeatedly voiced in the literature, and in reports of assorted Government Committees. Responding to this, a Committee on Taxation of Agricultural Wealth and Income (the Raj Committee) was appointed in 1972. The major thrust of the Raj Committee was to establish a nationally uniform system of agricultural taxation that would, above all, be progressive, in place of the land revenue which is assessed at a flat rate per acre regardless of the size of holding. The principal recommendation, was a progressive schedular agricultural holdings tax (AHT) on agricultural income, defined to include income from livestock, fisheries, poultry and dairy farming.

The Raj Committee AHT was not accepted by any State government. The Committee marks a major hiatus in the attempt to tax agricultural income in the country, because the rejection of its recommendations placed the final seal of political impossibility on the entire issue. It will be argued however in this report that the AHT was faulty in design, and that its principal defects were the attempt at universal coverage of all crops, which required information on the cropping pattern of each cultivator for assessment purposes, and the absence of any systematic exemption provision for idiosyncratic crop failure in the form of yield thresholds (as distinct from non-idiosyncratic yield failure covering an entire region). Instead, there was a nationally uniform threshold for taxable income of the holding which, given the average regional crop yields used for the computation of taxable income, translated essentially into region-specific thresholds in terms of size of holding.<sup>11</sup> These aspects of the design of the AHT, reflecting the central concern of the Committee with the need for national uniformity and progressivity in the rate structure, led to a scheme which required far too much information, including on the current cropping pattern of each holding; and paradoxically had at the same time no exemption for idiosyncratic crop failure specific to a particular cultivator.

The essential point of departure of the scheme recommended in this report from that of the Raj Committee is that **no attempt is made to find a universal substitute for the land revenue presently in place.** The cross-sectional pattern of relative rates of land revenue can be left untouched, with the absolute rates themselves reset if need be at their indexed value. However, the **pressure for this kind of rate revision has to be endogenously generated through jurisdictional retention of land revenue at panchayat level, accompanied by a hard budget constraint, rather than exogenously imposed.**

The presumptive crop-specific supplementary levy recommended here is specified per acre sown to a particular crop, not with respect to total income from a crop, aggregating across acreage sown to it. Following from this, there is no acreage threshold. But there is a need for a taxable threshold per acre, which is what is specified in terms of crop yield, a readily observable indicator, rather than net income, which is not readily observable.

Chapter II is a review of precept in respect of agricultural taxation, and Indian practice. The Raj Committee recommendations are presented in some detail, and the

departures from the Raj Committee approach in that adopted here.

Chapter III presents land revenue rates in Karnataka in terms of both the basic levy and the total levy after inclusion of cesses presently applicable, and also rates of agricultural income tax levied on plantation crops. Those aspects of the historical experience of land revenue in the region of relevance for the present study are also briefly covered.

Chapter IV is a brief description of the area in northern Karnataka where the field survey was conducted. The three crops surveyed in Karnataka are all commercial crops. Two are "sunrise" crops cultivated through bilateral tie-ups between growers and seed companies: propagation of tomato seed and sunflower seed, which require irrigated land in otherwise dry conditions. These conditions are found in northern Karnataka. The third is intercropped chillies-cotton, traditional commercial crops of the region, grown under unirrigated conditions. The results more than bore out the prior expectation of diversity in returns to agriculture. The samples selected are small, and serve as no more than a prototype for the kind of survey required.

Chapter V presents the variable cost norms for the three crops from the field survey. A first requirement for a presumptive agricultural tax is stability in the percentage of surplus over total variable cost to total revenue. Instead of taking a simple average across cultivators, the surplus is plotted as a function of yields per acre for each crop. The yield per acre at which the percentage stabilises serves as a natural endogenously generated exemption threshold. The survey results are presented in some detail so as to serve as a prototype for field surveys of other activities. The approach used, although confined here to crop cultivation, can and should be extended to non-cultivation primary activities like livestock-rearing and shrimp farming, where there is prima facie evidence of taxability.

Chapter VI adds on fixed costs to the operating costs of Chapter V to obtain taxable income, on which the suggested levies are based.

Chapter VII presents a summary of recommendations.

## NOTES

1. As modified by the annual Finance Acts enacted after the Central Budget of every year.
2. The Report of the Raj Committee (Government of India, 1972) mentions three other States: Maharashtra, Meghalaya and U.P. Maharashtra, listed in the Raj Committee among the States with an Agricultural Income Tax, has since abolished it. Meghalaya continued the Agricultural Income Tax Act of Assam of which it was previously a part, but no revenue was collected since there were no plantations in Meghalaya. The U.P. Act was replaced by the Vrihat Jot Kar Act of 1962 on large landholdings exceeding 30 acres. This was an ad valorem levy on the annual value of land, determined by application of specified multiples to the rental value of land. Although the multiples varied with respect to class of land, the levy was more in the nature of a property tax than an income-based land tax.
3. As stated by the Raj Committee Report. However, confinement to plantation crops was not necessarily always the case; see Chapters II and III.
4. In the years 1990-93, aggregate land revenue collected by all States was of the order of Rs 600 crores per annum, and the agricultural income tax yielded of the order of Rs 150 crores. In 1993-94, however, revenue from the agricultural income tax declined to around Rs 100 crores, and land revenue increased sharply by over 100 crores (Indian Public Finance Statistics, 1996: table 3.2). See however Chapter III for figures of collections in Karnataka, where the agricultural income tax has displayed exceptional buoyancy since 1994-95.
5. The most recent statement is perhaps that by Ahmed-Stern, 1989 in the Handbook of Development Economics, (Vol. I). The lone dissenting voice seems to have been that of Gandhi, 1966, who cautions against inferring replicability from the efficiency outcome of taxation of agriculture in Meiji Japan, because the initial conditions obtaining there in the form of widespread irrigation may not exist elsewhere.
6. Karnataka has been an exception since 1983; see Chapter III.
7. The changes in Karnataka are recorded in Chapter III of this report.
8. District planning committees have been mandated under the 74th Amendment to co-ordinate urban and rural development at district level.
9. Although it does not eliminate the burden on the current generation resulting from capitalisation effects of the land tax.
10. We are indebted to Mr. T.R. Sathishchandran for pointing this out.
11. The holding threshold would vary also from cultivator to cultivator by cropping pattern; see Chapter II.

## **CHAPTER II**

### **AGRICULTURAL TAXATION: A REVIEW OF PRECEPT AND PRACTICE**

Section II.1 of this chapter briefly summarises prescription from the literature in respect of the ideal form of agricultural taxation, and section II.2 summarises present-day practice in India. Section II.3 examines in considerable detail the Agricultural Holdings Tax (AHT) of the Raj Committee, and the possible reasons behind the non-acceptance of the AHT. Although more than 25 years in the past, the Committee represents the last major official attempt to devise a suitable agricultural tax for India. Section II.4 differentiates the approach recommended in this report from that of the Raj Committee and its variants.

#### **II.1 PRECEPT**

Bird provides the following four-fold classification of taxes leviable on agriculture<sup>1</sup> (Bird, 1974: 145-162):

1. Taxes based on land;
2. Taxes based on an income concept;
3. Taxes based on a rental value concept; and
4. Special purpose taxes.

Land taxes assessed on the basis of land area are the simplest in structure and administration and first in historical sequence. Agricultural land is an important productive asset, in inelastic supply, and unequal in its distribution. From the viewpoint of both efficiency and equity, it is a natural base for taxation, and has been so seen by economists from Ricardo (see Wald, 1959; Hicks, 1961; and Kaldor, 1962, all of whom recommend presumptive taxation based on the potential output of the land). Land-based taxation requires good land records, which are generally available in all but the most poorly-administered countries. Stratification with respect to differences in the productive capacity of the land is essential, most basically with respect to presence or absence of irrigation. This distinction is based on productive capacity, and would apply uniformly to all irrigated

land whether privately or publicly irrigated. A stratified land-based levy is not designed to take the place of supplementary special taxes, charged to capture part of the private benefits accruing from publicly-provided irrigation, or other public works.

A conventional income tax on agricultural income based on self-declaration supported by books of accounts is difficult in general, except in the context of large-scale organised operations like plantations. It is impossible in the context of unorganised farming in developing countries, because of the difficulties of verification and monitoring of large numbers of petty cash transactions. Any broad-based taxation of agricultural incomes must therefore necessarily be presumptive in character, based on an objective assessment of taxability. It is important to emphasise that presumption does not mean caprice, and that any objective assessment of taxability must necessarily relate taxable income to objective and easily measurable indicators of income-generating capacity through field surveys with adequate cross-sectional coverage. In the case of agriculture, the most obvious indicator is land cultivated. Thus, since any properly-designed land tax must be based on income generated by the land, the distinction between land-based and income-based taxes evaporates in practice.

An alternative approach could be based on rental value or on an equivalent capital sum, the approach adopted in property taxation of urban land or structures, but difficult to apply in the agricultural context, where sale or rental transactions are too sparse to provide reliable location-specific values. For the same reason, special purpose taxes such as capital gains taxes or betterment taxes, which are designed to capture increases in land values which are "due to the ordinary progress of society and not to any expenditure of capital or any exertion or sacrifice on the part of the owners" (Bird, 1974:156) are difficult to implement in the context of agricultural land.

An area-based tax eliminates having to deal with the valuation problems mentioned above, or those that arise when there are structures or improvements on land that are not yield-enhancing, or when land value rises in response to location factors unrelated to potential income from use for agricultural purposes. Clearly, an area-based land tax will have to be indexed to product-price inflation and to productivity increases; a valuation-based land tax is on the other hand implicitly indexed to asset-price inflation, which is different from the income concept that basically underlies the tax. The Uruguayan 1967

experiment with a presumptive land-based agricultural tax failed for example because soil quality classifications in terms of fractions or multiples of the national average, were based on easily challenged valuation records (Tanzi, 1991). There are on the other hand successful instances of valuation based systems, to quote from Rajaraman, 1995:

"..... such as in Chile, where income was presumed at 9% of land value until 1954, 10% thereafter. Land values were updated with reference to an index based on agricultural commodities, which was a clever way of leaving relative values unchanged, and which seems to have been legally robust. There are other systems in place such as in Costa Rica (5% of immovable property value in agriculture and stock-raising) and in Colombia (10% of the value of livestock and land excluding superstructures, subsequently reduced to 8% with the extension of the levy to the non-agricultural sector), although the details of the updating mechanisms are not known" (Rajaraman, 1995: 1113).

The most often cited and most successful practise of presumptive land-based taxation of agriculture is the French 'forfait' which is based on land calibrated in physical units. The forfait leaves room for negotiation with, and reference to the books maintained by, the taxpayer, within the parameters of the presumptive norms (Rajaraman-Singh, 1995). Variants of this system are practised in Francophone Africa, although it is not known with what degree of revenue success.

Through a combination of precept and practice, there is a mainstream consensus that taxation of agriculture can most effectively be attempted through a presumptive income-based tax on land calibrated in physical rather than value units, stratified by crop, region and irrigation status, with provisions for catastrophe exemption and for periodic updating of the yield and cost norms used (Rajaraman, 1995: 1112). For recent endorsements of the incontrovertible need for presumptive land-based taxation of agricultural income in developing countries, see Ahmed-Stern, 1989; and Rao, 1989.

Hoff, 1993 voices a recent preference in the literature for a mix of output and land taxes over a pure land tax regime (Hoff, 1993:332-351). An output tax is however very different from a land tax in that the collection efficiency for an output tax is likely to be highest at points of levy removed from the immediate jurisdiction of production. This reinforced by inter-jurisdictional competition, which makes it all but impossible that any one tax jurisdiction would impose an indirect tax of this type on itself unilaterally, makes output taxation leviable only globally. Although apportionment of the revenue so collected by origin is possible to some degree of approximation, the revenues from land-based taxes are



more clearly jurisdictionally marked and are therefore the more appropriate source from which to finance local public provision of improvements to agricultural infrastructure whose benefits accrue within chosen jurisdictional confines. Under long-run competitive equilibrium, the incidence of a global output tax falls entirely on the consumer of agricultural products, which is certainly one way of transferring resources into agriculture, and in an equitable way since the burden is in proportion to consumption. Thus, while output taxes certainly have their merits, they are in no sense a competing levy with land-based taxation of the income generated within the sector.

It goes without saying that land-based taxation is an alternative to non-transparent taxation of agriculture through price controls and import-protected industrialisation. It becomes feasible only when that structure has been sufficiently dismantled, as is now the case in India.

The case for taxing agriculture to finance productivity-enhancing agricultural infrastructure (irrigation, roads, research extension) is formally justified by Newbery, 1992. This report does not review time series studies on crop productivity/yields in Indian agriculture to justify the urgent need for local public efforts to improve crop productivity and/or stem or reverse environmental and other damage. The case for a land-based tax stands, independently of the urgency of this need.

## **II.2 AGRICULTURAL TAXATION IN INDIA**

When the income tax was first introduced by the Government of India in 1860, there was an experimental phase until 1886 during which agricultural income was by turns included and excluded from taxable income, and the income tax itself alternately imposed and withdrawn (see Table A.1). When the income tax was reimposed permanently in 1886, agricultural income was exempted on the grounds that agriculturists were already paying land revenue. The exemption remained in place thereafter through subsequent enactments, but in response to the recommendations of the Todhunter Committee which emphasised the need to tax agricultural income over and above land revenue, the Income Tax Act of 1935 granted Provincial Governments the right to tax agricultural income.

No attempt is made in this report to track the Provincial/State legislation on agricultural income taxation subsequent to the Central Enactment of 1935 empowering them to do so. The difficulties of subjecting agricultural income to taxation under conventional self-declaration made the revenue yield negligible at all times. Today the State-level agricultural income tax is levied in very few States, and where levied is reduced essentially to a tax on plantation income.

The agricultural income tax in Karnataka, the regional focus of the exercise conducted for the report, is described briefly in Chapter III along with land revenue in the State. In Karnataka, there is a presumptive option to the agricultural income tax, called a "composition scheme", under which flat levies progressively structured by size of holding may be paid as an alternative, independently of actual production, upto a ceiling of 50 acres. The Karnataka scheme is not crop-specific, but Kerala offers a similar "compounded rates" option which is. These schemes already in place in some States indicate very clearly that the presumptive option in the agriculture context is known and currently on offer, and that a more widely-based presumptive scheme for taxation of profitable crops or activities would not be unacceptable in conception.

No coverage of agricultural taxation in India would be complete without reference to the treatment of agricultural property under Central taxation of wealth and capital gains. Table A.2 lists the Wealth Tax Enactments pertinent to agricultural property. All agricultural property was included in taxable wealth between 1970 and 1981, subject to an exemption threshold and exclusion of the value of growing crops. Between 1981-83, taxability was confined to plantation property alone. After 1983, all agricultural property has been exempt. During the entire period 1971-83, when agricultural property was taxable, the wealth tax was payable only by individuals and not by companies. Thus, the revenue yield from taxation of agricultural property could never have been more than negligible.

Proceeds from sale of agricultural land and property were liable to the capital gains tax between 1961-70, but excluded thereafter except for property falling within an 8 km. radius of municipal boundaries (Table A.3).

Land revenue remains the only universal levy on agriculture, under legislative provisions that vary from State to State. There was a major reform of land revenue during

the colonial period. Indeed, it is the colonial land surveys conducted more than a century ago that constitute the basis on which land revenue rates are levied to this very day, in those areas where "settlement" rates were levied on the individual cultivator (the "ryotwari" system). In areas covered by other systems where the levy was on an intermediary, either a landlord or a collectivity like a village, the post-independence elimination of intermediaries and subsequent settlement with individual cultivators was often ad hoc or negotiated. The rate structure in these areas therefore bears less historical continuity than in ryotwari areas where the colonial pattern continues more or less unchanged.

Land revenue rates are revised in principle every thirty years, but in practice are not adequately indexed to inflation or productivity improvements in the interim. In some States like Karnataka (see Chapter III), there are explicit provisions in the land revenue legislation prescribing that rate revisions should not incorporate productivity improvements effected in the thirty years prior to rate revision. In others, there are prescribed limits to the rate increase permissible. Not surprisingly, the land revenue has dwindled into revenue insignificance, from a share of 50% of all tax collections at the turn of the century, to 7% at the time of independence (Ahmed-Stern, 1991:15). Today, land revenue contributes around 0.8% of total tax revenue, aggregating across Central and State revenues (as of 1994-95).

The basis of the land revenue is fundamentally presumptive, in that the levy is conceived of in relation to the productive capacity of the land. This report does not provide details on the present basis of determination of land revenue rates in the different States. However, the information given in the Raj Committee report on State-wise land revenue provisions as of 1972 is tabulated in Table A.4; the basis of rate determination and even the rates themselves are most unlikely to have altered since. There is variation within States encompassing areas under different systems of colonial settlement; in regions where intermediaries were eliminated, the subsequent settlement of land revenue rate on individual cultivators was often ad hoc or negotiated. But it is clear with one or two exceptions that in principle, if not uniformly in practice, there is an underlying intent to relate the levies in however inadequate a fashion to land productivity, either explicitly through crop yields or implicitly by way of soil stratifications. It must be remembered that the quantum of the present-day levy is no indication of the basis of its determination. The

legislative lag structure ensures that neither the quantum nor the structure of present-day levies need bear any relationship to present-day patterns of land productivity. Very importantly from the point of view of this study, there are some States where there are flat rate crop-specific cesses on acreage sown to commercial crops, superimposed on the basic levy.

Dissatisfaction with the ineffectiveness of land revenue as a tax on agricultural income has very frequently been expressed in the post-Independence era. As early as 1956, much before the dramatic yield improvements of the green revolution, a review of Indian taxation sponsored by the Central Government said of the land revenue, "even if the yield were doubled (whether by revision of rates or by the long overdue reassessment of land values) it would clearly not represent an excessive burden" (Kaldor, 1956:4). The judgement that agriculture was undertaxed was shared by a number of subsequent commentators (Kalecki, 1960; Rao, 1961; Hicks, 1961; Bardhan, 1961; Groves and Madhavan, 1962; Little, 1964; Mathew, 1968; Joshi et.al., 1968; and Bhargava, 1972), although they differed on the manner in which taxation of agriculture should be reformed.

The theme of undertaxation of agriculture began to be sounded also in a number of official documents. What motivated these calls was the increased if uneven prosperity that had accrued to cultivators as a result of the green revolution. The Fifth Finance Commission went so far as to recommend a single global income tax covering all, including agricultural income (Government of India, 1969: 85). The Fourth Five-Year Plan recommended that the rate structure of State level taxation of agricultural incomes should be on par with the rate structure of the Central income tax on non-agricultural income (Government of India, 1970: 85). The Direct Taxes Enquiry (Wanchoo) Committee of 1971 also called for parity in taxation of agricultural and non-agricultural income.

In response, the Ministry of Finance, Government of India appointed a Committee on Taxation of Agricultural Wealth and Income (the Raj Committee) in February 1972 to suggest methods by which taxation of agricultural wealth and income could be used "more effectively for raising additional resources for development, for reducing economic disparities and for efficient use of existing resources". The committee submitted its report in October 1972.

The major recommendation of the Raj Committee was a State-level but nationally uniform progressive schedular agricultural holdings tax (AHT), to replace the flat rate, nationally non-uniform land revenue in a two-phase operation. The AHT failed to find acceptance in any State. The Committee did not call for Central levy of the AHT, but did suggest "partial integration" of agricultural income as calculated for purposes of the AHT with non-agricultural income of the assessee, for determination of the income tax slab rates applicable to the non-agricultural component. This second recommendation was implemented in the Finance Act of 1973, and remains in force to this very day (see Lakhotia, 1993, for the manner of operation of this provision).

The Raj Committee marks a hiatus in the Indian debate on agricultural income taxation. That neither the AHT, nor its variants suggested by Bagchi, 1979 and others found acceptability in any State seemed to set the final seal of infeasibility on agricultural taxation. **The rejection of the AHT is an important issue that must be examined before any fresh proposal for taxation of agricultural income is mooted.** Accordingly the next Section (II.3) of this chapter is devoted to an examination of the design of the AHT and its variants. The final section (II.4) differentiates between the approach adopted in this report and that of the Raj Committee.

A lull followed the Raj Committee and its aftermath. In recent years, however, calls for taxation of agricultural income have been sounded again. These fall in two classes.

One class consists of those concerned about the evasion possibilities that continue to arise from the exemption of agricultural income, despite the implementation since 1973 of the second Raj Committee recommendation for "partial" integration of agricultural income with other income in order to determine the slab rate applicable to the non-agricultural component. These writings (Pandey, 1991a; Lakhotia, 1993) focus on definitional ambiguities that make possible unwarranted shelter under the agricultural umbrella.

The second class consists of calls for taxation of agricultural income on equity grounds. These include Lakdawala, 1983; Kahlon, 1983; Shah, 1986; Pandey 1991 b and c; and Burgess and Stern, 1993. Some of these, such as Pandey, 1991c, suggest agricultural taxation on a presumptive basis. Some others, such as Lakdawala, 1983,

advise against it, on the grounds that a tax on potential income cannot be as progressive as a tax based on assessment. Surprisingly, some recommendations can still be found in recent literature for taxation of agricultural income under the Central income tax (Guhan, 1995:87) or for rate parity with the Central income tax (Pursell and Gulati, 1995:296).

This report recommends that taxation of agriculture should not be attempted on any basis other than land-based presumption using survey-generated norms, except perhaps for the plantation sector. There is simply no information on the basis of which self-declared income can be verified and assessed. **Since the most serious departures from the presumptive principle in the land revenue as it presently operates arise in respect of areas that have experienced recent alterations of irrigation status, or where improved crop strains, or new crops or activities have been introduced, the appropriate point of departure for a more equitable tax on agriculture would be in the form of a supplementary levy on these profitable avenues, whether crop cultivation or allied land-based primary activities.**

This report does not suggest a comprehensive overhaul of the land revenue. That would require resources beyond the reach of cash-strapped State governments today. Indeed, rate revisions within the existing structure are often delayed much beyond the minimum stipulated period because of insufficiency of funds. That is not to suggest that present land revenue rates should necessarily be left untouched. There is considerable scope for indexation of these rates to inflation of product prices since the last revision of settlement rates.

However, any upward revision of land revenue rates will be complied with only if the taxpayer is a beneficiary of the public goods made possible by the enhancement of rates. **That is why the first step towards a more equitable tax on agriculture necessarily has to be the transfer of powers of levy of land revenue to panchayats. That, coupled with a hard budget constraint on downward fiscal transfers from State governments to panchayats, will generate panchayat-level pressures for enhancement of the land revenue, and greater willingness to comply resulting from local retention of the revenues so raised.**

At the same time, protection against downside revenue variability has to be ensured by making the land revenue an obligatory panchayat levy, at rates prevailing at the time of transfer of powers of levy. This will fortify panchayats in their confrontation with initial

pressures to lower or repeal the tax within their jurisdictions. Where there is an acreage exemption threshold for applicability of land revenue, as there is in Karnataka for example, there is a strong case for removal of these thresholds at the time of transfer of the levy to panchayats. The crop-specific supplement can remain an option.

Most advocacy of agricultural taxation is based on casual observation of pockets of rural prosperity. There are very few survey-based attempts to address the issue of whether agricultural income is taxable. One exception is Arneja, 1986, which is based on a 1978-79 field survey of 300 owner cultivators from 12 villages in 4 districts of Punjab. Arneja concludes:

"Farm business income has been rising, but the rise in taxes has not been in accordance with the increase in income of the farmers as per the principles of taxation ..... The percentage contribution of direct land taxes has been much less for the large and big farmers as compared to marginal, small and medium farmers with respect to their farm business income" (Arneja 1986:636).

This report does not endorse the call of Pandey, 1991c for reimposition of Central wealth and capital gains taxation on agricultural properties. Multiple tax burdens imposed by other levels of government will only place obstacles in the way of effective panchayat-level taxation of agriculture.

### **II.3 RAJ COMMITTEE PROPOSALS**

The Raj Committee found two basic defects in the pre-existing land revenue system (the land revenue system prevailing in the region surveyed for this study is described in chapter III):

1. The incidence of land revenue in relation to the productivity of land was not uniform over the country, because of the different land revenue systems in force historically in different parts of it; and
2. land revenue was assessed at a flat rate per hectare and hence was not progressive.

Thus, the principal defects of the land revenue system as seen by the Committee were a lack of national uniformity, and a lack of progressivity in the rate structure. As a

remedy for these defects, and to subject agricultural income to the same degree of progression applicable to other sectors of the country, the Committee proposed replacement of the land revenue by a progressive agricultural holdings tax (AHT) on agriculturists with no other assessable income. Income from livestock, fisheries, poultry, dairy farming etc was to be subject to the AHT. In the case of assesses having non-agricultural taxable income, income from agriculture as computed for the AHT was to be included in total income for the purpose of calculating the income tax slab rates applicable to the non-agricultural component, with the agricultural component taxed separately at AHT rates. This partial integration of incomes was suggested primarily to check the tendency to evade taxation of non-agricultural income by reporting part of it as agricultural income. However, the Raj Committee AHT remained a schedular, source-specific levy in conception. The AHT was to be supplemented with a tax on agricultural property and a tax on capital gains arising out of transactions in such property. Gains from transactions in assets held for not more than a year were to be treated as ordinary income and taxed accordingly.

The AHT was a tax on the Taxable Rateable Value (TRV) of an agricultural landholding. The tax liability under the AHT on the  $j$ th holding was:

$$\text{AHT}_j = (X/2) \% \text{ of TRV}_j; \text{ where}$$

"X" : the TRV in units of a thousand rupees.

This formula was recommended for the purpose of building in progressivity in the rate structure, and on a continuous scale, since X permitted non-integer values. Thus, the rate applicable on a holding with a taxable rateable value of Rs. 8,800 was 4.4%. For  $X/2 < 0.24$ , the Committee recommended a nominal tax of Re. 1/holding. Thus, the AHT threshold was a TRV of Rs. 480.

#### **Computation of Taxable Rateable Value of Agricultural Holdings:**

1. **Stratification:** The country was to be divided into sufficiently soil-climatically homogenous districts/tracts.
2. **Yield norms:** For each tract, norms of yield per hectare of different crops were to be prepared each year based on an average of the previous ten years, and these



yield norms were to be valued at the relevant average harvest prices of the preceding three years to obtain the value of gross output of different crops.

3. **Rateable value:** The excess of gross output per hectare over paid-up costs was termed the rateable value of the crop. Paid up costs were defined to include only material and labour costs actually paid out by the farm operator for current cultivation. The imputed cost of family labour was treated as part of the income of the family.<sup>2</sup>

Thus, for the  $i$ th crop:

$$RV_i = [1 - f_i] GO_i$$

where

- RV : Rateable value/hectare.  
 GO : Value of gross output/hectare.  
 f : Fraction of gross output that goes out as paid-up costs.

For each district/tract, there would be a schedule of  $RV_i$  of land per hectare for all  $i$ . Grouping of crops into crop groups was suggested,<sup>3</sup> with each such group given a single rating in terms of rateable value. The schedule was to be prepared for each year and included in the legislation of the year in question. **The Committee did not recommend that field surveys be conducted for the determination of paid up costs, assuming perhaps that standard cost of cultivation surveys provided a ready source of information. However, these surveys are not available at the level of regional disaggregation recommended by the Committee, nor do they have comprehensive crop coverage.**

4. **Assessable rateable value:** The assessable rateable value of the  $j$ th agricultural holding was obtained from the above schedule of crop-specific rateable values by deducting expenses of irrigation (actual rates for irrigated crops from public sources, and imputed at 20 percent of the RV for irrigation from private sources), thus:

$$ARV_j = 0.8 \sum_i [RV_i] H_i \text{ for privately irrigated land}$$

$$ARV_j = \sum_i [RV_i] H_i - [\text{water charges for publicly irrigated land}].$$

where

- ARV<sub>j</sub> : Assessable rateable value of  $j$ th holding.  
 H<sub>i</sub> : number of hectares devoted to  $i$ th crop.

5. **Taxable rateable value:** From this a further 20%, subject to a maximum of Rs. 1000 (termed the 'Development Allowance'), was to be deducted to obtain the taxable RV of the holding. Thus,

$$TRV_j = 0.8 [ ARV_j ], \text{ where } 0.2 [ ARV_j ] < \text{Rs. } 1000$$

$$TRV_j = ARV_j - 1000, \text{ where } 0.2 [ ARV_j ] \geq 1000$$

Thus, the TRV threshold of Rs 480 implied an ARV threshold of Rs 600. The development allowance was meant to cover costs of soil conservation, digging of wells, other maintenance and depreciation.

The following were the essential operating features of the AHT:

1. **Taxable base:** The operational holding = land owned minus land leased or mortgaged out plus land leased or mortgaged in. The basis of assessment was the family and not the individual. Trusts, companies etc., were not exempted, but had special rates and procedures for assessment.
2. **Frequency of assessment:** Annual, in accordance with the crop composition of the holding. The rateable values of the crops in turn were to be updated annually on the basis of moving averages (ten years) of yield, and (three years) of price.
3. **Implementation:** Two phases. First, all operational holdings with ARV of Rs 5000 or more were to be brought under the AHT. In the second phase, holdings with ARV of less than Rs 5000 were to be covered.

The first objection to the AHT in the discussion that followed was that, since the proposed tax was on operational holdings, it left out income from agriculture; that such rental income was not covered by any other of the actual or proposed taxes; and that it therefore allowed the perpetuation of an anomaly and an element of regressivity in the taxation of agriculture (Rao, 1972 and Sothiya, 1973). Raj, 1973 agreed that ownership may be made the basis of tax, with the tax liability on the holding apportioned between owners and tenants on leased-in land. The second criticism of the AHT was that, even if care was taken to demarcate as tracts only areas that were broadly homogeneous in respect of soil and climate, the use of the estimates of average productivity of land under any crop (or crop-group) in a tract as norms for assessing the potential productivity of all land under that crop within the tract might be iniquitous and therefore objected to on legal

grounds. Raj, 1973 offered no solutions to this. On the administrative burden of annual assessment, Raj suggested a move to triennial or quinquennial assessments. This however would have served only to exacerbate the inequity inherent in a levy based on average yields. The phased implementation of the AHT also came in for criticism, because it would have meant a period of dual operation of the AHT and land revenue (Dantwala, 1972).

Bagchi, 1978 suggested that the AHT could be made administratively simpler, while retaining its essential character, if the following modifications were introduced:

1. A uniform RV was specified for each area/tract with respect to the gross value of output of only one or two major crops grown in that area, without taking account of all crops grown;
2. Paid out costs were estimated at a flat 30% of gross value of output for all crops.
3. Norms were fixed on the basis of averages of output for five years (instead of the ten year average suggested by the Raj Committee), and the corresponding assessments kept in force unchanged for a period of five years, barring radical alterations in the productivity of the land, or when prices change by more than a specified percentage;
4. The basis was ownership holdings instead of operational holdings;
5. Milder progressivity were attempted, with 2.5% on the first Rs 3500 ARV (net of paid-up cost) of a holding, 5% on the next Rs 3500, 8% on the next Rs 3500, and 10% on the rest (although this rate structure is actually more progressive upto an ARV of Rs. 20,000), and a flat rate of 8% on companies, trusts etc whose beneficiaries are unknown.

Although the Raj Committee had detailed consultations with the state governments, its recommendations did not find favour with most of them. The Haryana State government made an effort to implement a form of AHT, but the Haryana version was quite different from the system recommended by the Raj Committee. At the present time, Haryana has repealed even the land revenue, one of the few states to have done so. The suggestion for partial integration of income was the only recommendation of the Raj Committee which was enacted in 1973 and continues to remain in force to this day. However, because agricultural income is self-declared with no possibilities of verification, and continues to be

tax exempt, the revenue leak from classifying non-agricultural income as agricultural has not been fully plugged (in the words of the Tax Reforms Committee, partial integration "has not served much purpose").

The Lakdawala Committee considered in detail the Raj Committee AHT. Apart from examining the administrative implications of enforcing the AHT, the Committee also attempted to estimate the likely yield from the tax on the basis of an exercise relating to seven districts of Uttar Pradesh. It was found that the switch over to the system of AHT would reduce land revenue in five of the districts studied and increase it in two of them. On this basis, it was calculated that the application of the AHT scheme to UP as a whole might result in a net loss of revenue, aside from the administrative difficulties of implementation (U.P. Taxation Enquiry Committee Report, 1980).

## **II.4 THE APPROACH OF THE PRESENT STUDY**

The differences between the approach adopted in the present study and that of the Raj Committee are listed below and justified.

1. **Land Revenue:** The Raj Committee was driven principally by the need to replace the present State-level flat rate land revenue with a nationally uniform, progressive agricultural income tax. The crop-specific levy advanced here is intended to supplement the land revenue already in place.
2. **Level of Implementation:** The scheme suggested here is not designed for merger with the Central income tax. Nor is it designed like the Raj Committee AHT for nationally uniform schedular application at State level. It is suggested that both the base land revenue and the crop-specific enhancements be levied at panchayat level, with local retention of the revenues so raised for improvement of local agricultural infrastructure.

The justification for levy at panchayat level is that reduction of the distance between government and the governed makes possible in principle greater downward accountability, and hence better compliance. At the same time, the base land revenue should be enacted as an obligatory levy at present rates, so as to fortify panchayats in their confrontation with local pressures to repeal the levy. This limits downside variability,

and coupled with a hard budget constraint on transfers from higher levels of government, will generate a local stake in both indexation of base land revenue rates to product-price inflation, and in imposition of the crop-specific supplements, which can remain optional levies at rates worked out by a State-level technical body. Finally, the information required for the crop-specific levy will be easily and costlessly accessible only at panchayat level.

3. **Progression:** The crop-specific supplementary levy recommended here is specified per acre sown to a particular crop, not with respect to total income from the crop, aggregating across acreage sown to it. There is thus no progressivity in the rate structure with respect to size of holding, unlike the AHT rate structure. Rate increases by area sown to a crop of the AHT kind rather than flat rates per acre only encourage avoidable splitting of holdings and benami practices. The scheme suggested here does carry progression implicitly, since only those crops which yield higher returns (and which are clearly entry-barriered because of factor-specificity such as special soil requirements or other reasons, so that the disparity persists in equilibrium) are subject to the supplementary levy.

4. **Stratification:** The approach taken here is crop and region-specific, akin but not identical to the earlier Raj Committee AHT. It differs radically from the Bagchi proposal for basing the tax on the major crops grown in an area, which carries a possible incentive to move into the designated crops from those yielding lower returns. The Bagchi approach was not adopted here for two reasons:

- i. In practice, it could be seriously inequitable if there is no freedom to move into the designated crops. No matter how narrowly regions are delineated, there is sufficient variation within any region in soil quality, even within irrigated/unirrigated strata, that such freedom cannot automatically be assumed.
- ii. There could be minor horticulture or other crops in any region which are much higher income-yielding than the major crop of the region. Confinement to the major crops grown in an area where these are of low profitability and hence taxability, could lead to an unwarranted loss of revenue from an entire region.

5. **Phasing of Implementation:** The specification of crop-specific norms on the basis of field surveys in the present study is the major point of departure from the approaches recommended hitherto, and is the fundamental difference from which flow all its other features such as the particular manner of phasing implementation, which can only be

sequential, with an initial focus on the crop/s known to be most profitable in each area. Because the technical expertise for conducting the field surveys will be available only at State level, there will have to be a process whereby the District Planning Committees forward to the State government a list of agricultural activities selected for initial survey. Whichever among these proves to be taxable will then be the first to be implemented. The Raj/Bagchi schemes were intended for comprehensive implementation on all agricultural land, with sequencing in implementation of the Raj Committee AHT recommended only with respect to the level of rating of the holding, essentially with respect to the size of the holding. This was possible because neither the Raj nor Bagchi schemes were predicated on field surveys.

6. **Field Surveys:** The need for fresh field surveys arises for two reasons:

- i. Standard cost of cultivation surveys are confined to the major field crops for which price support operations are in place. There is no equivalent standardised source of information on horticultural and other crops, nor for non-cultivation primary activities like aquaculture, which together constitute the new "sunrise" sectors within agriculture broadly defined. Since it is these which are expected to lead the agriculture sector in the future, there is a need for survey-based information on rates of return to such activities coupled with a lack of existing sources of information through the official data-gathering machinery.
- ii. Because of the present-day diversity of agricultural activity, it is not possible to stop at collecting information on gross yields alone, and use standard factors to obtain net return therefrom (the need for such factors exists even in the Bagchi approach, where it necessarily has to underlie the calculation of tax liability). The assumption of homogeneity in both the AHT and Bagchi approaches in this regard is understandable since there was far less diversity at the time those were formulated.

Even with field surveys, the resulting levy will be acceptable only if the norms resulting from the survey on the basis of which the levy is arrived at are made explicit, and if local consensus is sought on the reasonableness of both the norms and the levy.

7. **Gross Output vs. Marketed Surplus:** The Raj Committee did not adjust for surplus at all, perhaps because of the expectation that smaller cultivators with a lower marketed surplus would in any case fall below the threshold of taxable rateable value, which is specified with respect to the holding taken as a whole, rather than per hectare. In the crop-

specific approach proposed here, if a food crop is sufficiently profitable so as to be taxable in a particular area, but if smaller subsistence cultivators have a lower marketed surplus, and hence a smaller cash income as a percentage of gross output, an adjustment can be worked in (see Chapter VI).

**8. Imputation:** Family labour is imputed, unlike the Raj Committee approach which explicitly recommends that savings on hired labour costs from use of family labour constitute a part of taxable family income. The manner in which this imputation is done is detailed in chapter IV. The reasons for including the imputed cost of family labour are as follows:

- i. Any expectation of cross-sectional stability in input norms in cultivation can only relate to the total labour requirement, not the hired component alone. Variability in total factor use can in principle be thought of as endogenous to the enterprise; variability in hired factor use is a function of in-house availability, which is exogenous in the short-run (and there is no case for setting up adverse incentives for expanding family labour supply in the medium-term).
- ii. Since wages of agricultural labourers are not taxable, the equivalent return to family agricultural labour should also be non-taxable. Returns to agriculture should be computed only after deduction of such non-taxable components.

Other home-produced inputs are also imputed since, for a crop-specific approach such as this, it is immaterial whether the input involves a cash outlay or foregone income.

**9. Taxable Threshold:** Perhaps the single most critical requirement of any scheme for agricultural income taxation is the need to adjust for variability in agricultural yields, cross-sectionally within a region (idiosyncratic) and covering an entire tract or region (non-idiosyncratic). A threshold that does not systematically accommodate downside yield variability is seriously deficient in the agricultural context.

The Raj AHT had a rateable value threshold of Rs. 480 per holding, which translated essentially into an exemption for small holdings since the yield figures on the basis of which the threshold was calculated were obtained from standard crop averages unadjusted for idiosyncratic yield failure. The rateable value threshold of Rs. 480 was nationally uniform, but because regional crops yields would differ, the implicit size-of-holding

threshold would vary by region, and also between cultivators and over time for any cultivator, since the rateable value of any holding was a function of its cropping pattern. The Bagchi scheme had both an exemption by size of holding (1 hectare irrigated; 2 hectares irrigated) and a threshold specified in terms of rateable value (Rs. 5000) which, like the Raj Committee threshold translates into a threshold in terms of holding size with no provision for idiosyncratic yield failure.

Since the Raj and Bagchi approaches were heavily dependent on yield averages, an attempt was made to strengthen those averages by using yield series extending five or ten years into the past. Yield averages over time serve no purpose. "Sunrise" activities are so recent that time series on yields do not go back very far, but for the unirrigated crop covered in this survey with a longer history of cultivation in the region, comparison with other surveys in past years suggests a sharp yield decline in recent years. Thus, reference to yields even in the recent past might actually overstate returns to agriculture in such cases.

For non-idiosyncratic yield shortfalls covering an entire region, the Raj scheme provided for discretionary suspension of liability to pay the AHT "on a liberal basis", with crop failure defined as "less than half the norm established on the basis of average output of the earlier ten years" (Raj Committee, 1972:34). The Bagchi scheme also carried a provision for "full or partial remission, as may be required, in exigencies like floods and drought" (Bagchi, 1978:1635). Neither of these provisions takes care of idiosyncratic crop failure.

The focus in the present study was on developing an endogenously-generated threshold from the relationship between net income and crop yields, that then serves as a yield threshold for all crop failure, whether idiosyncratic or non-idiosyncratic.

**10. Inter-crop Equity:** Inter-crop equity is ensured by the two-stage procedure recommended here, whereby the selection of crops forwarded by the local bodies for consideration accords with the local ordering in terms of profitability, and the technical survey following defines a further subset based on objective evidence. There cannot be any national uniformity in this respect nor indeed should such uniformity be sought. Since the purpose of this tax is to enable public provision of productivity enhancing improvements



to agricultural infrastructure, failure to implement the tax can only be a local decision with implications that, in the first instance, will be local rather than national.

**11. Frequency of Assessment:** The Raj Committee recommended annual assessment, and required information on the complete cropping pattern of every cultivator. A move to quinquennial assessment in that scheme, or the Bagchi version, would only exacerbate the inequity inherent in a comprehensive levy of that type applicable aggregatively across crops with average yields. The scheme developed here suggests annual assessment limited to those farmers growing any of a few designated crops, at a pre-determined rate of levy per acre applying above a specified yield threshold, with information required only in respect of whether a particular farm falls in any year above that threshold or below it. More ambitious systems could be devised, with perhaps a second rate of levy per acre for a yield slab above the minimum, but that would carry a higher information cost. The single rate of levy is worked out at the threshold yield, not the average yield (see Chapter VI).

**12. Owned vs. Operated Land:** Finally, the study here recommends taxation of land owned rather than land operated, in accordance with the consensus reached in the debate following the Raj Committee Report. The field survey however collected data on yields and costs of cultivation without reference to whether the land operated was owned or leased in.

## NOTES

- 1 Bird, 1974 also states the case for agricultural taxation; Heller, 1954 is one of the many earlier sources.
- 2 The imputed cost of farm produce used as inputs for agricultural production within the farm was not regarded as legitimately deductible unless all such produce was fully taken into account in the estimation of the gross output of the farm.
- 3 Although the criterion for grouping is not clear. The report suggests either rateable value, or crops showing a "high degree of local concentration", where it does not follow that the latter should necessarily be similar in terms of rateable value.

## **CHAPTER III**

### **LAND REVENUE AND THE AGRICULTURAL INCOME TAX IN KARNATAKA**

Section III.1 presents a brief summary of the present provisions in respect of land revenue and the agricultural income tax in Karnataka. Present-day Karnataka includes areas drawn from five pre-independence states: Bombay Presidency, Madras Presidency, Coorg, and the princely states of Mysore and Hyderabad. Section III.2 covers those aspects of the historical experience of land revenue in these areas of relevance for the present study. Section III.3 provides present-day land revenue rates in Karnataka. Section III.4 covers the presumptive "composition scheme" which is available as an alternative to regular assessment for the agricultural income tax, for holdings upto 50 acres in size.

#### **III.1 INTRODUCTION**

Land revenue is presently levied in Karnataka under the Karnataka Land Revenue Act, 1964. The basic land revenue in Karnataka has not been shared by the State government with panchayats ever since the 1983 enactment of new panchayat legislation in the State (the Karnataka Zilla Parishads, Taluk Panchayat Samitis, Mandal Panchayats and Nyaya Panchayats Act). Prior to 1983, the basic land revenue was shared with local bodies, as reported by the Raj Committee (Government of India, 1972:149).<sup>1</sup> It might seem paradoxical that the pathbreaking 1983 legislation which was intended to strengthen panchayats should have withdrawn a tax-sharing provision previously in place, but the intention seems to have been to replace a feeble revenue flow with a more substantial grant of Rs. 10 per capita.<sup>2</sup>

Following the 73rd Amendment to the Constitution, the Karnataka Panchayati Raj Act 1993 (Act No. 14), as amended by Ordinance No. 1 of 1995, continues to leave the basic levy entirely with the State government, but provides for a cess of 100% on the basic levy, the revenue from which is to be given to panchayats by origin of collection. This provision has not been implemented so far.

The position at the time of the field survey in June 1995, and at the time of writing, is that three cesses are imposed on the basic levy together adding up to 75% of the basic levy. Of this, 50% is a local government cess which is however not shared with local government. Gram panchayats receive an annual block grant of Rs. 1 lakh unrelated to population. There is also a 25% health and education cess on the land revenue, which accrues to the relevant departments of the State government and not to panchayats. The additional provision by the Tenth Finance Commission for local governments is to be given to gram panchayats at the rate of Rs. 12 per capita, if matched by Rs 6 raised locally.

When the new provision for a 100% cess shared by origin is implemented, it will give local government a stake in improved collections. As in other States, the land revenue in Karnataka is presently revenue-insignificant. "Settlement rates", as they are called, must by statute be left unchanged for a minimum of thirty years, and even when revised, do not incorporate changes in cropping pattern or yield improvements in the interim because of a critical section of the Karnataka Land Revenue Act, which ensures that land that changes in irrigation status within a thirty year period prior to any revision of settlement rates is not re-classified. Further, land irrigated under major irrigation schemes does not (ever) change its classification, so that rate revisions do not reflect the resulting enhancement to crop yields (see Section III.2 below for details). The irrigation investment by the State government is inadequately recovered through independent water charges. The setting of land revenue rates with respect to principal crops covering two-thirds or more of cropped area in a particular land category<sup>3</sup> means that profitable minor crops are not fully taxed. Finally, there is a relatively high exemption threshold of 10 acres for unirrigated dry land,<sup>4</sup> below which no land revenue is payable.

Land revenue collections are estimated to have amounted to a mere 0.26% of SDP from agriculture in 1989-90.<sup>5</sup> The (implicit) buoyancy of land revenue, from the decline over time in its share of SDP from agriculture, is negative.

Karnataka is among seven States which presently levy an agricultural income tax, confined to plantation crops. The set of plantation crops has a common core across the states, with some variation at the fringes; in Karnataka, for example, it includes cardamom, coffee, linaloe, orange, pepper, rubber and tea, but excludes arecanut and coconut. When initially introduced in 1955 in the then Mysore State,<sup>6</sup> the agricultural income tax covered

25 commercial (including plantation) crops; later this was expanded to as many as 39 commercial crops (Joshi et.al., 1968: 227-228). The poor revenue yield from other crops led starting 1982 to confinement to plantation crops alone. This reinforces the point repeatedly made in Chapters I and II, that taxation on a self-declaration basis is infeasible in all but the plantation context. What distinguishes plantations is the ready availability of yield norms per standing tree or plant, and standardised capital and operating costs. Paradoxically, assessment is possible for plantation crops because presumptive norms are so readily available.

As a percentage of SDP originating in agriculture in 1989-90, revenue from the agricultural income tax amounted to 0.21%, close to collections from the land revenue despite the much more limited crop coverage.<sup>7</sup> The buoyancy coefficient is also greater than one. After the phased freeing of coffee plantations starting December 1992 from compulsory sales at controlled prices to the Coffee Board, collections from the agricultural income tax jumped from Rs. 17 crores in 1994-95 to Rs. 50 crores in 1995-96. Although collections in the following year fell to Rs. 37 crores because of a fall in world coffee prices, it is clear that the agricultural income tax in Karnataka has entered a new phase in terms of buoyancy.

Land revenue is deductible from taxable income before levy of agricultural income tax.

### **III.2 A HISTORY OF SURVEY AND SETTLEMENT OF LAND REVENUE**

The principal feature of the Mughal land revenue system, which covered all but the southern reaches of the deccan prior to British colonisation, was the very high rate of levy, at one-half or more of average gross produce (Habib, 1982: 238). When these assessments were made annually, there was some in-built possibility of adjustment for yield variation, but when the assessment was fixed in money terms for a term of more than one year, the levy was oppressively inflexible. Post-Mughal systems were sometimes even more oppressive. During the reign of the later Peshwas, a system termed "revenue farming" was introduced whereby each district was auctioned for revenue and transferred to the highest bidder, who was then free to recover his revenue contribution in any manner from the cultivator (Fukuzawa, 1982a: 259 and 1982b:182). Among other things it was

found that village level revenue records had become corrupted where revenue farming was in force.

The systems of revenue settlement introduced in the colonial period fell into three classes:

1. Settlements for single estates under one landlord.
2. Settlements for estates of proprietary bodies, usually a village community.
3. Settlements for individual occupancy, called the ryotwari system.

In the first two classes the land is settled by Government with the landlord or village community, and individual cultivators are the tenants of these proprietors. Under the ryotwari system, the land is settled on the individual cultivators themselves.<sup>8</sup>

When the British administration of Bombay Presidency decided to replace revenue farming with ryotwari settlement, there was a need for re-survey because of the corrupted land records at village level, and also because of the lack of uniformity in measurement and assessment from one field to the next. The survey of the Bombay Presidency was begun in 1835 and completed in 1891. The "settlement rates" in what is termed the Bombay model do not seem to have been predicated in any explicit manner on either gross produce or net profit. Instead, the settlement officer seems to have been free to use his judgement on ability to pay, based in turn on historical levels in the region, modified by "pragmatism" (Fukuzawa, 1982b: 185-186; and Kumar, 1982: 226). The settlement rates in the Madras Presidency on the other hand seem to have been predicated more explicitly on the net produce of the land (Qureshi, 1954: 404).

The Bombay settlement was a success nevertheless because of the use of uniform measures of land area<sup>9</sup>, and the general quality and accuracy of the soil-based classification of land. The Bombay survey became the model used in the neighbouring princely states of Hyderabad and Mysore. In these areas as well, the need for a fresh survey arose because of corruption of land records by local officials, and because of a general lack of central control leading to spatial variation in the number of rates applied to any class of land. There were 32 different rates of assessment on dry land alone in the Mysore region, and as many as 596 in the Bangalore region (Karnataka Revenue Survey Manual, I:4).

Although the settlement rates themselves have been revised since, at intervals of approximately thirty years, the land surveys completed in the colonial period more than a century ago continue to remain the basis for the assessment of land revenue. In areas settled by the colonial administration with intermediaries rather than directly with the cultivator, found in only a few pockets of Karnataka, the post-independence elimination of intermediaries led to settlement with the cultivator on an ad hoc or negotiated basis. In these areas there is therefore less historical continuity than in areas under the ryotwari system.

### **III.3 PRESENT-DAY LAND REVENUE RATES**

Land revenue rates in Karnataka have remained unchanged since the last settlement in 1965.<sup>10</sup> The unit of settlement is called a zone. Each zone is broadly homogenous, but the boundaries conform to administrative demarcations. Zones are further subdivided into upto eight groups on the basis of physical configuration, rainfall, nature and yield of crops, and thereby implicitly soil quality.<sup>11</sup> Within each zone/group, there is further subdivision into three classes, dry land, wet land and garden/plantation land, as follows (Government of Karnataka, 1984:3-4).

Dry land ("kushki") is land without private sources of irrigation, where the rainfall is not sufficient to permit cultivation of paddy, sugar-cane or other water-intensive crops. However dry land covered by major irrigation schemes of the State government, which make possible the cultivation of wet crops, retains its original classification nevertheless. Thus dry land need not necessarily be unirrigated land.

Wet land ("tari") is land where water-intensive crops can be grown, with either groundwater irrigation or surface irrigation from local rain-fed tanks, which are not the property of the State government, or under rain-fed conditions. Thus wet land need not necessarily be irrigated land.

Garden land ("bagayat") is land covered with garden crops, defined to exclude plantation crops. Bagayat land can be either rainfed or irrigated. The distinction between dry and wet bagayat land is akin to that between kushki and tari, i.e. by type of crop, with unirrigated bagayat where the rainfall is sufficient to sustain wet garden crops classified as wet bagayat, and the same exception for canal-irrigated lands.

Plantations are in a separate category, and were exempt from payment of land revenue until 1976, when settlement rates were notified for plantation lands.

Thus, the differentiation between dry, wet, garden, and plantation land is crop-based,<sup>12</sup> with complications arising only in respect of dry land that has subsequently become irrigated by major irrigation schemes. The crop-specific enhancement suggested in this report is therefore in line with the conventional basis of distinction in terms of land revenue rates.

A critical provision in the legislation which ensures a more than thirty-year lag between any change in the crop-based status of a piece of land, and a corresponding change in its classification for land revenue purposes, is Section 117 of the Karnataka Act which reads as follows:

"If during thirty years immediately preceding the date on which the settlement for the time being in force expires any improvements have been effected in any land by or at the expense of the holder thereof, the increase in the average yield of crops of such land due to the said improvements shall not be taken into account in fixing the revised assessment thereof".

The above is perhaps the single most important legislative provision underlying the stagnation of land revenue rates in Karnataka. Another reason is the high threshold of 10 acres of dry land, below which no land revenue is payable other than a fee of Re 1/- per annum (this remission however does not apply to canal irrigated land that has retained its classification as dry land). Holdings above the exemption limit are however charged for the full holding.

Table III.1 reports the minimum and maximum standard rates by zone on each class (dry/wet/garden). Standard rates are determined at 4% of the cash value derived from the average gross yield<sup>13</sup> of the principal crops<sup>14</sup> on land of the highest soil value in that zone/group/class. Actual rates are specified fractionally with respect to the standard rate. Called "bhaganne", these are specified in terms of annas, with soil of 100% value in a particular category said to be of 16 anna quality (from the old equivalence of Re 1 to 16 annas). If there is no land within a particular group of sufficient quality, the standard rate is purely notional, and actual rates are some fraction of the notional standard. There is no clear indication of the lowest value that land can have and still be declared arable; possibly 3 annas or 19% (Karnataka Revenue Survey Manual; II(2):10). Thus even the minimum

standard rates reported in table III.1 are the maximum applicable in the relevant category.

Table III.1

Land Revenue Standard Settlement Rates in Karnataka By Zone

(Rs/acre/annum)

Land revenue zone	Dry land		Wet land		Garden land		Planta-tions
	Min.	Max.	Min.	Max.	Min.	Max.	Flat
North Kanara K.I	0.64	0.64	4.73	7.69	11.23	19.68	-
K.II	1.40	1.72	6.01	9.87	10.76	24.51	-
K.III	1.45	1.45	7.19	9.40	30.43	39.90	-
Dharwar K.IV	1.67	3.83	6.35	9.47	6.35	9.47	-
K.V	2.98	3.64	7.08	7.08	15.27	16.27	-
K.VI	1.70	3.13	1.70	7.97	1.70	3.13	-
Bijapur K.VII	0.96	1.35	7.52	7.52	0.96	1.35	-
K.VIII	1.55	2.75	7.52	9.40	7.52	9.40	-
Belgaum I	0.90	3.46	6.02	9.72	6.02	9.72	-
II	2.61	6.26	7.85	7.85	7.85	7.85	-
III	1.06	2.66	1.06	2.66	7.85	7.85	-
Gulbarga I	1.82	2.91	9.60	9.60	1.82	2.91	-
II	1.20	2.97	8.53	11.84	1.20	2.97	-
Bidar I	1.42	3.77	8.92	8.92	8.92	8.92	-
Koppal	1.54	3.65	15.65	15.65	1.54	3.65	-
Lingasugur	1.31	1.74	6.54	6.54	6.54	6.54	-
Chitradurga IV	2.28	2.77	6.40	7.96	7.68	9.60	-
V	1.36	2.45	8.32	10.59	11.52	12.80	-
VI	1.48	2.08	8.32	10.90	11.52	11.52	-
Tiptur VII	3.06	3.13	9.88	13.21	7.68	12.23	-
Bangalore VIII	2.32	3.40	8.44	11.84	16.00	22.40	-
IX	2.81	3.36	8.68	9.73	8.96	10.24	-
Kolar X	3.94	4.48	9.02	9.68	9.02	9.68	-
XI	3.01	3.35	9.14	9.62	9.14	9.62	-
Hunsur XIII	2.50	3.95	10.00	15.00	13.00	15.00	-



Land revenue zone	Dry land		Wet land		Garden land		Plantations
	Min.	Max.	Min.	Max.	Min.	Max.	Flat
Mandya XV	2.96	4.06	14.05	23.02	14.05	23.02	-
Holenarasipur XVI	2.54	3.14	9.77	13.36	9.77	14.72	7.60
Bellary	2.40	2.93	13.70	13.70	11.52	11.52	-
Kudlagi	2.40	2.72	10.72	10.72	11.52	11.52	-
Shimoga I	0.71	1.21	9.17	9.75	6.25	8.30	6.25
Chickmagalur II and Hassan	1.14	4.54	8.59	10.33	6.00	21.65	8.35
Tarikere III	2.11	4.79	10.92	11.82	14.10	14.37	7.60
Mysore XIV	2.21	4.21	6.94	10.92	15.18	16.42	-
Kollegal	2.49	5.18	12.21	12.21	6.00	8.00	11.25
Coorg	1.60	4.19	9.90	11.20	9.90	11.20	9.36
Udipi	1.60	1.60	7.48	9.44	8.05	18.92	-
Puttur	1.20	1.60	6.58	9.47	8.84	12.39	11.56
Chamarajanagar XII	2.15	4.06	15.64	15.64	11.87	18.04	11.25
Shahapur	2.22	2.87	9.14	10.90	2.22	2.87	-
Gangavathi XXXXI	2.05	3.10	18.96	21.60	12.64	14.40	-
Raichur XXXX	2.10	2.87	21.68	25.73	14.45	17.15	-

**Source:** Mysore/Karnataka Gazette Notifications.

- Notes:**
- Standard rates are determined at 4% of the cash value derived from the average gross yield of the principal crops on land of the highest soil value in that zone/group/class. Actual rates are specified fractionally with respect to the standard rate.
  - The system underlying the numbering of zones is not immediately apparent.
  - For zones whose rates were modified and notified only in 1976 (see footnote 7) the rates presented are the modified rates.
  - In some zones, such as Belgaum II and Gangavathi XXXXI, there are two rates for garden (bagayat) land: a higher rate for "patasthal bagayat" (surface-irrigated) and a lower rate for "motasthal bagayat" (well-irrigated). The higher rate is the one reported in the table. In others, such as Tarikere III, there is a general rate, and a higher rate for land sown to areca; in these cases, the table reports the general rate.

In all zones, the rates are lowest for dry land, and usually highest for garden land, although in some zones (such as Gulbarga I and II) the highest rates are on wet land. The

rates vary by group, although there is no uniform convention regarding group numbering. In some zones the maximum rate is to be found in group I, in others the group I rate is the lowest, and the variation across groups is not always monotonic. In some zones there is no variation across groups at all. In some zones the (flat) plantation rate is lower than on garden land.

Table III.2 summarises the minimum and maximum rates in the State on each type of land, in terms of both the basic levy, and the consolidated levy after inclusion of the 75% cess. The area selected for study (see chapter IV) falls in zone V of Dharwar district except for a small adjoining taluk falling in zone IV.

**Table III.2**

**Summary of Land Revenue Standard Rates in Karnataka**

(Rs/acre/annum)

Group	Dry land		Wet land		Garden land		Plantation	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Basic land revenue	0.64	6.26	1.06	25.73	0.96	39.90	6.25	11.56
Cess (75%)	0.48	4.71	0.80	19.29	0.72	29.92	4.69	8.67
Levy inclusive of cess	1.12	10.97	1.86	45.02	1.68	69.82	10.94	20.23

### **III.4 THE COMPOSITION SCHEME FOR TAXATION OF PLANTATION INCOME**

The agricultural income tax in Karnataka, as a schedular tax on plantation crops, based like the Central income tax on self declaration (which is verifiable at least in principle for an organised activity like a plantation) does not directly concern the scheme proposed in this paper, which is intended for application to agriculture as an unorganised activity. What is of relevance is that Karnataka has for many years offered a presumptive option to the agricultural income tax, called a "composition scheme," under which progressively slabbed flat levies per acre may be paid as an alternative and independently of actual production. From April 1994, the scheme is binding for three years; in earlier years the assessee could opt in and out of the composition scheme from year to year.

The rate structure under the composition scheme is as follows:

<u>Acres</u>	<u>Levy (Rs.)</u>
< 15	-
15 - 20	750/acre
20 - 25	1000/acre
25 - 30	1400/acre
30 - 40	1750/acre
40 - 50	2250/acre

These enhanced rates have been operative since April 1995. It is estimated that around 60-80% of assesseees opt for the scheme, and that the percentage so opting has increased over time despite the enhancement of rates. This indicates the buoyancy of returns to plantations after the opening up of coffee sales in 1992.

The composition scheme is not crop-specific, although there are schemes elsewhere as in Kerala,<sup>15</sup> which are. It is clear that the principles along which a redesigned levy on agriculture is proposed in this report are not unknown within the levies presently applicable to agriculture, whether in Karnataka or elsewhere in the country.

The rates applicable to those not opting for the composition scheme with effect from 1 April 1997, as proposed in the State Budget of 1997, are as follows:

<b>Annual agricultural income (thousand rupees)</b>	<b>Individuals</b>	<b>Registered firms</b>	<b>Companies</b>
0 - 40	Exempted	40%	30%
40 - 50	10%	40%	30%
50 - 75	20%	40%	30%
75 - 100	30%	40%	30%
100 - 500	30%	40%	40%
> 500	30%	40%	50%

The rates above are of relevance only as a point of reference for the rates recommended in Chapter VI.

## NOTES

1. The Committee does not report the percentage shared or the formula used.
2. Panchayats were also given revenues from a 3% surcharge on stamp duty on transfers of property.
3. All crops occupying not less than 20% of the total gross cropped area and cash crops occupying not less than 5% of the total gross cropped area. As a working rule crops whether cereal or non-cereal together occupying at least 66% of the total gross cropped area in a group are taken into account.
4. Land irrigated by major irrigation schemes is also classified as dry, but does not get the 10 acre exemption.
5. These and other estimates which follow are from chapter 9 of a classified 1991 Report of a Commission on State Finances of the Government of Karnataka.
6. In Coorg State, subsequently merged into the present Karnataka State, an agricultural income tax was introduced in 1951.
7. See source in footnote 5.
8. A summary of land tenure systems in the pre-colonial period may be had from Irani, 1954.
9. Measures previously used included the "bijawari" system, by the amount of seed sowed on a plot.
10. The rates in a few zones were notified only in 1976, because of modifications to the initial revision.
11. Additional considerations listed in Section 116 of the Karnataka Land Revenue Act, 1964 are:
  - (a) Marketing facilities,
  - (b) Communications,
  - (c) Standard of husbandry,
  - (d) Population and supply of labour,
  - (e) Agricultural resources,
  - (f) Variation in the area of occupied and cultivated lands during the previous thirty years,
  - (g) Wages,
  - (h) Ordinary expenses of cultivating principal crops including the wages of the cultivator for his labour in cultivating the lands,
  - (i) Sales of lands used for purpose of agriculture.

12. This classification applies only since the Act of 1964. Kumar says that historically wet lands were those irrigated by public waterworks, such as government canals or village tanks; dry lands were not so served, but might be irrigated by privately-owned wells; and garden lands were "improved" lands (Kumar, 1982:219). However, the Raj Committee report says that in Karnataka, prior to the Act of 1964, dry land was unirrigated and wet lands were those irrigated from government sources; implying that garden lands were those privately irrigated (Government of India, 1972: 149). This classification is orthogonal to that of Kumar in respect of the dry and garden categories.
13. There is no explicit attempt made to compute net profit realised by the cultivator, or to relate this to yields.
14. See footnote no. 3. According to the report of the Raj Committee, the rate is 1% of the value of gross produce in areas where the principal crops are plantation crops (Government of India, 1972: 148).
15. Called a "compounded rates" scheme, it is specified in slabbed rates per hectare but is confined to plantation crops. For those not opting for the compounded rates scheme there is a Plantation tax in addition to the agricultural income tax which applies, also on a crop-specific basis, per hectare above specified exemption acreages, where the acreage is determined not by direct physical measures but by dividing the number of trees/shrubs/vines by standard measures of density per hectare.

## **CHAPTER IV**

### **DESIGN OF THE FIELD SURVEY**

The area chosen for the field survey followed from the two "sunrise" seed propagation crops selected for study. The particular configuration of climatic and soil conditions required for successful seed propagation is present in the northern region of Karnataka State. The third crop chosen for purposes of contrast is inter-cropped cotton-chillies, a traditional rainfed cash crop of the region: not prima facie a candidate for taxation.

Section IV.1 gives some background information on the constituent land revenue zones of the field survey area, which at the time of survey fell in Dharwad district. An administrative reorganisation of Karnataka State in August 1997 partitioned the seed propagation areas out of Dharwad into the newly created Haveri district.

Section IV.2 lists the general conventions adopted in the field survey. Sections IV.3 and IV.4 list input requirements of agricultural operations common to all three crops and specific to seed propagation respectively. The final usage norms can only be specified with reference to actual usage, which is a function of the number of times each task is performed. These survey findings are presented in chapter V.

Appendix B provides some background information on area, production and yield of important crops in Karnataka since the mid-fifties.

#### **IV.1 THE FIELD SURVEY AREA**

Figure IV.1 is a map of Dharwad district, at the time of survey (June 1995), with constituent taluks grouped into land revenue zones. Three zones: IV, V and VI of Karnataka, fell in Dharwad district as it was constituted at the time of survey. Three crops were selected for study: tomato seed propagation, and sunflower seed propagation, both examples of "sunrise" activities, which on the basis of prior information seemed to be potential candidates for taxation. The third crop activity we have selected is inter-cropped

cotton-chillies, which by contrast is a traditional cash crop of the region cultivated under rainfed condition without supplementary irrigation, and occupying approximately one third of the gross cropped area in the district. The purpose was to contrast returns to the newer more productive, but entry barriered, commercial crops with those on a more traditional commercial crop without entry barriers. Figure IV.2 shows the taluks selected for field survey. Seed propagation was surveyed in Ranebennur, Byadagi and Hirekerur. Intercropped chillies-cotton was studied in Kundgol and Hubli taluks. The August 1997 administrative re-organisation of the State partitioned Ranebennur, Byadagi and Hirekerur out of Dharwad into the newly created Haveri district. Kundgol and Hubli taluks remain in Dharwad.

These taluks all fall in land revenue zone V of Karnataka, with the exception of Hirekerur which lies in zone IV. From table IV.1 which presents rainfall data by taluk, it can be seen that these zonal groupings are essentially rainfall-based. The district had an average rainfall of 717 mm, heaviest in the hilly western region of Malnad (zone IV) and gradually decreasing to the rainshadow region in the east. There is sufficient precipitation in the western region (zone IV) that foodgrains like paddy can be grown during the kharif season on the onset of the monsoon even under rainfed conditions, with a rabi (post monsoon) crop also possible on residual moisture without irrigation. In the drier regions groundnut and inter-cropped chillies-cotton are grown as rainfed kharif crops. Seed propagation requires dry conditions during the crop growth period and can therefore only be taken up during the rabi season. It requires well-drained soils, which excludes the damp Malnad region and essentially confines it to the dry rain-shadow areas of the district. It also requires an assured source of irrigation, which is sourced in the study area from underground water, with the percentage of cultivable area so served not exceeding 15% in any taluk (table IV.2). Thus, the entry barriers to seed propagation are immediately apparent. There is also a canal-irrigated zone VI where three taluks come within the command area of the Malaprabha reservoir, but the other conditions for seed propagation do not obtain here.

The south-west monsoon sets in the first week of June followed by the north-east monsoon in October-November. The region receives 75 to 95 per cent of the total precipitation of the year during the months from June to November and the rest during the months of April and May. Thus there is a long period from December to March which is

reliably free of precipitation. It is this which has made the region one of the centres of seed propagation in the country.

**Table IV.1**

**Average Rainfall by Land Revenue Zone**

<b>Taluk</b>	<b>Average rainfall (1901-70)</b>	<b>No. of rainy days</b>
<b>ZONE IV</b>		
Kalghatgi	939.7	77
Hangal	933.4	67
Dharwad	838.5	68
Hirekerur	809.8	65
Shiggaon	727.9	66
<b>ZONE V</b>		
Kundgol	777.9	42
Haveri	770.1	65
Byadagi	712.6	59
Hubli	693.0	53
Savanur	692.6	51
Ranebennur	623.1	52
<b>ZONE VI</b>		
Shirahatti	748.9	46
Gadag	667.7	51
Ron	613.1	48
Navalgund	612.1	46
Nargund	545.0	39
Mundargi	489.0	36
<b>DHARWAD DISTRICT</b>	<b>717.2</b>	<b>55</b>

**Source:** Karnataka at a Glance, Directorate of Economics & Statistics, Government of Karnataka, 1993.

**Notes:** Zones IV, V and VI of Karnataka fell in Dharwad district at the time of the field survey (June 1995).



Tomato and sunflower seed propagation are grown over a three-four month season spanning the months of October-January. Intercropped chillies-cotton is grown over a five-six month season spanning the months of July-December.

A total of 33 cultivators were surveyed from the five taluks selected. These yielded a sample of 16 for tomato seed propagation, 13 for sunflower seed propagation, and 10 for intercropped chillies-cotton (some cultivators grew both tomato and sunflower). The sample is admittedly small. The purpose was merely to provide a prototype of the kind of survey necessary. A more comprehensive coverage of the selected crops was beyond the scope of the exercise.

The total land operated by the sample cultivators including land not sowed to the selected crops is as follows:

**Land operated by sample cultivators (acres)**

	Owned	Leased in (net)	Total
Irrigated	122.00	6.00	128.00
Rainfed	478.25	28.00	506.25
Garden	22.50	-	22.50
Total	622.75	34.00	656.75
Average	18.87	1.03	19.90

The average land operated among the sample, at 19.90 acre (8 hectares), is higher than the average holding size of 2.90 hectares recorded in the 1990-91 agricultural census for Dharwad district. However, the taxability issue has been examined per acre sowed to the selected crops, independently of total holding size. Of the 33 sample cultivators, one was a marginal farmer (under 1 hectare); 4 were small farmers (1-2 hectares). According to the 1990-91 agricultural census, marginal farmers (under 1 hectare) constituted 15.31 per cent and small farmers (1-2 hectares) 34.44 per cent of the total holdings in the district, and 3.08 per cent and 17.96 per cent respectively of the total operated area.

FIGURE IV.1

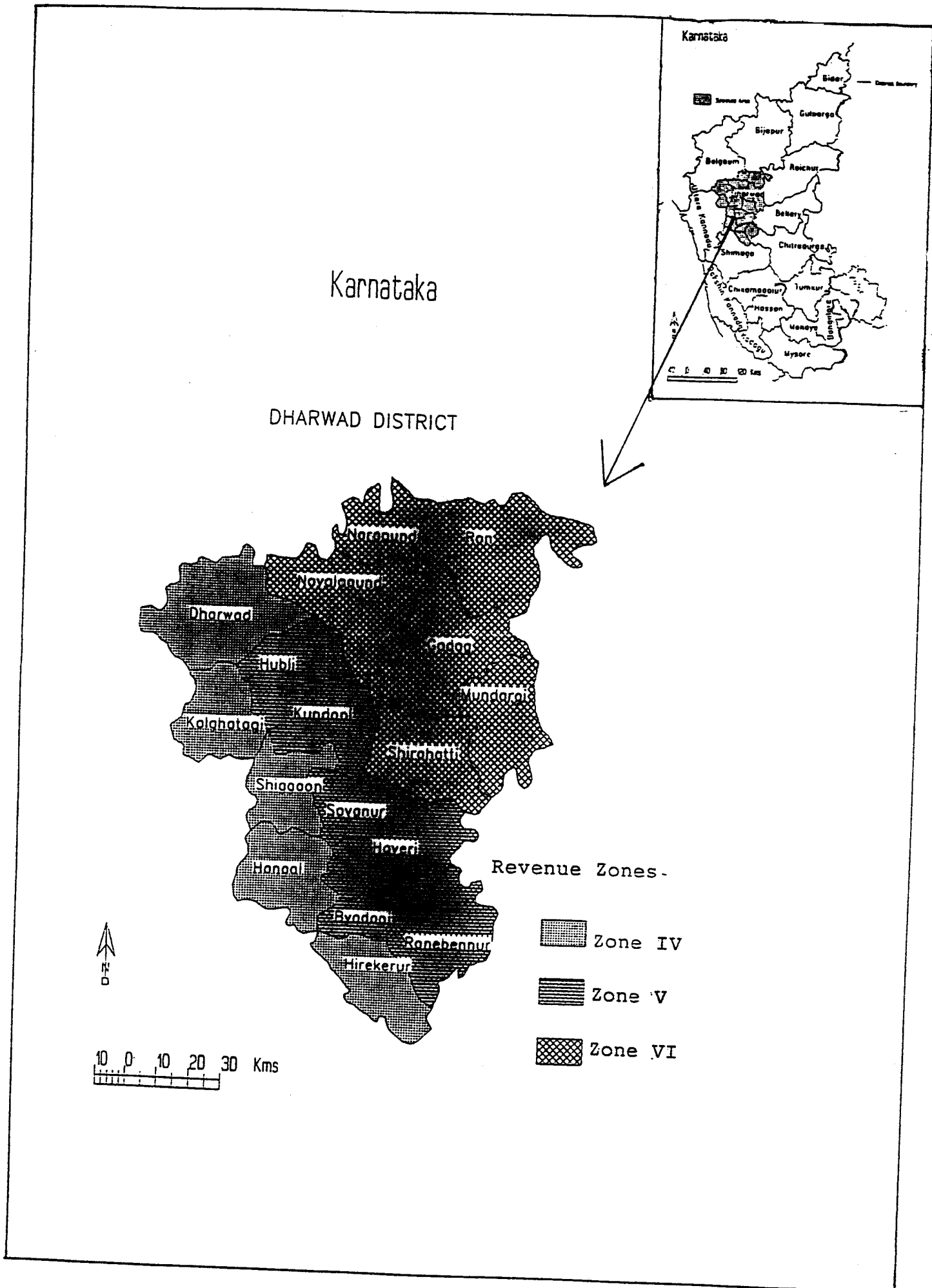


FIGURE IV.2

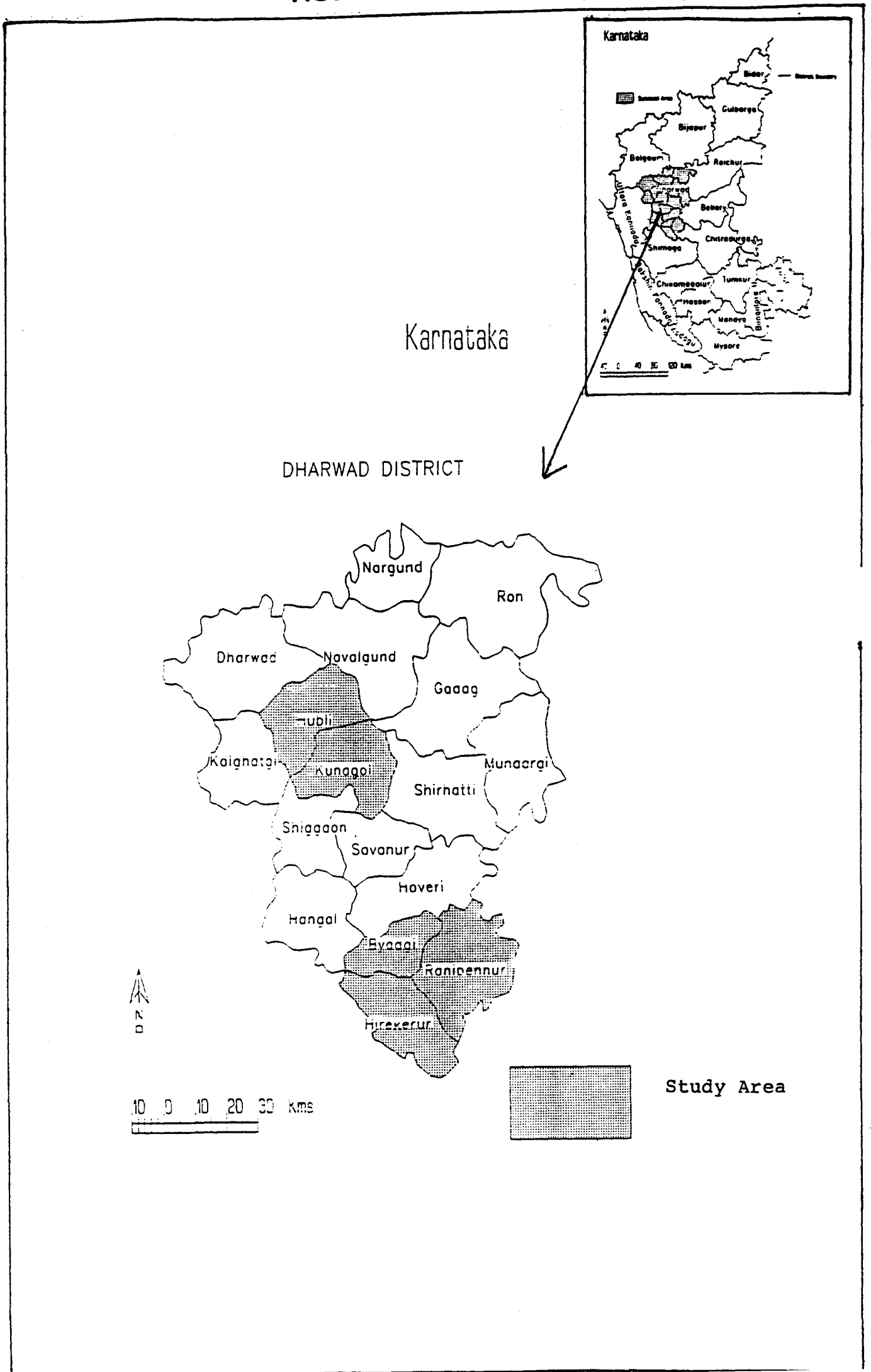


Table IV.2

## Net Irrigated Area by Land Revenue Zone

(in hectares)

	Taluks	Canals	Tanks	Wells	Borewells	Other	Total	Net cultivable area	% of total cultivable area
ZONE IV	Kalghatgi	-	2405	145	1221	-	3771	40648	9.28
	Hangal	5070	9676	68	2710	1489	19013	486678	3.91
	Dharwad	-	678	1247	1976	170	4071	79365	5.13
	Hirekerur	-	2690	3088	3624	1263	10665	56053	19.03
	Shiggaon	-	26	-	982	-	1008	43141	2.34
ZONE V	Kundgol	-	20	-	18	-	38	61104	0.06
	Haveri	-	-	-	2931	4863	7794	65367	11.92
	Byadagi	-	30	590	2050	-	2670	30521	8.75
	Hubli	2006	146	160	318	333	2963	63171	4.69
	Savanur	-	-	323	1671	846	2840	48924	5.80
	Ranebennur	-	-	517	2978	6722	10217	66822	15.29
ZONE VI	Shirhatti	-	119	2016	1849	781	4765	73863	6.45
	Gadag	-	-	1088	160	-	1248	104494	1.19
	Ron	3078	364	4751	4416	556	13165	116980	11.25
	Navalgund	15326	-	1784	-	5503	22613	104831	21.57
	Nargund	30819	-	311	63	460	31653	41387	76.48
	Mundargi	-	-	2414	898	2477	5789	57428	10.08
<b>DHARWAD</b>		<b>56299</b>	<b>16154</b>	<b>18502</b>	<b>27865</b>	<b>25463</b>	<b>144283</b>	<b>1540777</b>	<b>9.36</b>

Source: District Statistical Abstract: Dharwad District, 1992.

Notes: 'Other' irrigation is water lifted from perennial or seasonal rivers or from sewage.

## **IV.2 THE FIELD SURVEY: GENERAL CONVENTIONS ADOPTED**

1. Input usage was normalised per unit area sown to the crop in question, which does not correspond in all cases to natural units like an acre or hectare. For example, the natural unit of area sown to tomato seed is 30 guntas, which corresponds to 0.75 acres.
2. Following from the need to account for non-hired inputs, survey efforts were focused on identifying inputs in physical units, to the extent possible, and on deriving expenditures therefrom rather than recording expenditures directly. Particular care was taken to record labour use regardless of whether formal hiring took place, and to impute expenditure on family and other non-hired labour at opportunity cost.
3. There were some operations for which labour was hired not by the day but for completion of a task, such as the staking operation for the tomato plant for example. For these, the person-day equivalent was obtained by application of the modal daily wage to total expenditure. There were some operations, like cotton harvesting for example, where payment is by piece-rate per kilogram harvested. In such cases, the person-day equivalent was obtained by application of a uniform norm of quantum of work done per person-day to total expenditure on harvesting labour.
4. There were some non-labour inputs for which physical norms were impossible to identify, as for example chemical fertiliser and pesticides, neither of which seem to have been applied in anything like a standard package. Likewise, the quantity of manure is not indicated in the tables because manure application is reported by farmers not in standard units like quintals, but in units like tractorloads (varying in price between Rs 150 to 200 per tractorload) and cartloads (varying in price between Rs. 40 to Rs. 70 per cartload). Nor can the total expenditure be converted to a physical equivalent in standard units, because there is no uniform price per quintal of manure. Manure itself is non-standardised, with wet manure commanding a lower price per unit weight than the dry equivalent, especially if the latter is from an anaerobic process carrying a higher nitrogen content. Thus, for organic manure, chemical fertiliser and pesticides, there is only an expenditure norm.
5. Data on fixed costs were not collected in the survey. These are developed independently in chapter VI.

6. Although family labour has been imputed, the managerial input has not been included in cost. The returns are a measure of the reward for the management function.
7. Labour hiring is done in general for a day of roughly eight hours' duration. There are exceptions, such as the cross-pollination operation for tomato seed propagation, which can be performed only for a few hours a day, but is nevertheless compensated by an eight-hour wage, and thus a higher implicit hourly wage, because it is a skilled task. Other operations like irrigation are also performed for less than eight hours a day, but do not command a higher hourly wage, and have therefore been aggregated into person-days of eight-hour content at the wage paid for a day of standard duration by the farmer surveyed.
8. Usage of labour was found to be higher where family labour was available as compared to where only hired labour was used. It is also possible that where family labour was used, it may not have been for a full eight hours even though reported as a full day. The manday information as collected, with imputation of family labour at the going wage rate, may therefore somewhat overstate the cost of the labour component.
9. Bullock-hire includes the hire of the operator i.e. the ploughman. This fixed-coefficient labour has been incorporated with the bullock-day, and/or tractor-day, and the rates in both cases include payment for the operator. The rate per bullock-day is for the hire of a bullock-pair. Where two operators are hired with a single bullock-pair, as is sometimes the case for bullock-powered hoeing (interculturing), the additional labour-day has been separately accounted for. In the case of bullocks and tractors as in the case of labour, usage was observed to be higher when they were owned. Thus, the costing of these at opportunity cost most likely overstates the cost to the farmer since the opportunity of hiring out the equipment may not necessarily have been foregone.

### **IV.3 INPUTS INTO COMMON AGRICULTURAL OPERATIONS**

Although input requirements for the performance of some tasks can be specified even prior to detailed survey of any particular crop or region, the final norms can only be specified with reference to actual input usage, which is a function of the number of times each task is performed. These survey findings are presented in Chapter V. Seven



one ploughing with two bullock-pairs pulling a mould-board plough and 4 harrowings are performed).

The actuals recorded for each farm for any crop will be a function of the decision of the farmer on whether or not to plough, and on the number of harrowings. This in turn is dictated by the season in which the crop is grown and the crop grown in the previous season. In general, the mechanical energy requirement is higher for preparation of rain-fed land for kharif crops like cotton/chillies than for irrigated land, and within the latter, lower for rabi crops. Tomato and sunflower seed propagation are rabi crops, although tomato and sunflower grown for sale rather than seed may be grown in the kharif season as well. Thus, the ploughing requirement for tomato and sunflower is less than for chillies-cotton. The use of tractors for the rabi crop in particular is rare.

There is clearly a bullock-tractor trade-off, since each task within land preparation can be performed with either or in combination. At the modal rates of hire of Rs 75/bullock-day and Rs 1000/tractor-day, the bullock option is the more cost-effective for all but mould-board ploughing with two pairs of bullocks. If tractors are chosen nevertheless, that is often because the farmer owns the tractor, and has to pay only the incremental (diesel) cost of its use; there is also the time saved with tractor use. Once again, the higher use of tractors where they are owned suggests that the costing of owned factors at opportunity cost may impart an upward bias to the input expenditure norms developed here.

2. **Manuring:** Organic manuring after land preparation is performed for all crops. The labour input does not bear any necessary proportionality to the expenditure on manure across farms for a crop<sup>1</sup>, but it does vary across crops with the quantity of manure used.

3. **Sowing/transplanting:** The labour input under this head includes seedbed preparation. Where a mechanical input was used for this, it has been included under land preparation. Where transplanting is done, the component tasks are nursery planting; irrigation; and uprooting and transplanting into the field. The irrigation component is the equivalent in 8-hour days of labour usage at the rate of a few hours per day spaced out over two to four weeks, whereas transplanting is completed over a day or two. The



transplanting component is usually female, but the other components are not gender-specific.

Tomato and chillies are transplanted, but sunflower and cotton are not. In the case of tomato, the seed companies most usually supply seedlings rather than seed. Even where the starting point is seedlings rather than seed, there is nevertheless a two-stage transfer of the plant to the field, with a first-stage nursery, which requires a labour input for irrigation until transplanting at the second-stage. Seedlings cost more than seed, but there is a correspondingly lower labour requirement for the nursery.

4. **Weeding:** Bullock-power is used even after transplanting, before the plant is too high, to aid in the weeding operation (called 'interculturing'). The requirement is as follows:

**Per interculturing per acre:**

1/2 bullock-day

**Minimum:**

One round of interculturing.

Human (female) labour supplements bullock-powered interculturing and is at the same time a substitute for further rounds of bullock-powered interculturing. The use of upto 10 female-days per round of weeding per acre is more expensive at a modal wage of Rs. 15, than half a bullock-day by a factor of upto 4, and is clearly an option chosen only where family labour is available, carrying no cash outlay, and possibly no opportunity cost.

5. **Fertilizer Application:** The fertilizers applied are Diammonium Phosphate (DAP), urea and super-phosphate, usually in the form of compound fertilizers available in the market, like 20-all or 17-all. In addition, some farms sprayed micronutrient mixes containing boron, calcium, magnesium, molybdenum and zinc, in addition to more conventional fertiliser applied to the soil. As a result, there was no standard fertiliser package, and accordingly there was no uniformity to the labour input for application even within a crop. There is also no relationship between value of fertiliser and labour used in application, because micronutrients sprayed on the plant are more expensive but take less labour than fertiliser applied to the soil. This is a largely though not exclusively male operation.

6. **Pesticide Application:** As in the case of chemical fertiliser, there is no standard pesticide package for any crop, and it is impossible therefore to prescribe a norm for pesticide use in other than value units.

For the labour requirement, the following norm seems possible to specify:

**Per spraying per acre:**

0.5 - 3.00 man-days.

**Maximum sprayings:** 10 rounds

Actual usage of labour is a function of the number of sprayings. Pesticide application is entirely done with male labour. Wages vary depending on whether application is with a foot-pump (more arduous) or a power sprayer (less so).

7. **Harvesting and Processing:** For all crops except cotton, hiring is by the day. Cotton, the exception, is picked on a piece-rate system, the payment ranging between Rs 1-1.50/kg. of cotton picked.

For the tomato crop, the post-harvest processing of crushing the ripe tomatoes, passing the slurry through sieves to extract the seeds, and drying the seeds on wire meshes, carries a higher labour requirement than picking of the crop.

#### **IV.4 INPUTS INTO OPERATIONS SPECIFIC TO SEED PROPAGATION**

1. **Irrigation:** Seed propagation can only be done on irrigated land. The labour input is the equivalent in 8-hour days of a requirement spread over the entire growing season at the rate of 4-6 hours/day.

2. **Cross-pollination:** This operation calls for the largest labour input of any agricultural operation. It involves the pollination of female plants with pollen from male plants, both supplied by the seed company. In the case of the tomato plant, the procedure is especially arduous and labour-intensive, requiring emasculation of the female flower buds prior to the pollination itself. These procedures are performed over a period of approximately 30 days,

with a labour force of roughly between 8-13 labourers on each day per unit area. Pollination is performed in the early hours of the morning while the dew is on the plant, for a duration of two to three hours. In the evening, the task of emasculating female buds is performed for another 2-3 hours. The size of the labour force needed on each plot, and the month-long period over which it is required, is secured by hiring children, who are readily available since the timing does not conflict with the school-day. For the sunflower plant, the operation is performed over a 7-10 day period, with a labour force of between 3-5 on each day per acre. The hiring here is for a half-day; what is reported is the equivalent in person-days of eight-hour duration.

3. **Staking** (specific to the tomato plant): There are two component tasks to this operation, one involving the setting up of a structure of vertical and lateral poles, and the other the tying of the plant to the laterals. Pole-installation is exclusively male and often contracted out, but tying is performed by both males and females and hiring is by the day. The tying component carries a commonly quoted norm of 5 person-days/1000 poles, which at the mean number of 3500 poles/unit area cultivated (0.75 acres), works out to 17.5 person-days/unit.

4. **Watch and Ward** (specific to sunflower): Required for the protection of the ripening crop from birds, it calls for half-day hire of one labourer for a farm of upto 2 acres in extent for the last 15 days before the harvest.

## NOTES

1. The distance over which the manure has to be carried is a function of the location of the farm with respect to access tracks.

## CHAPTER V

### THE FIELD SURVEY RESULTS

#### V.1 YIELD AND REVENUE NORMS

Tables V.1 to V.3 present farm-wise data on yield and revenue for tomato hybrid seed propagation, sunflower hybrid seed propagation, and rainfed production of intercropped chillies/cotton respectively.

Table V.1 on tomato seeds lists the seed company supplying seeds/seedlings to each of the sixteen farms studied, from six villages spanning two taluks, Byadagi and Ranebennur. Each seed company offers a different price; with one exception, they vary within the range of Rs. 1600-1900/kg. The exception is company C which offers Rs. 3400/kg., for what is clearly a different variety (in general, the price varies inversely with the seed pulp ratio). Within the Rs. 1600-1900/kg. class, however, field interviews indicated no major differences in variety, with the price diversity coexisting in equilibrium because of limitations self-imposed by the company offering the highest price on the number of farmers with whom they enter into contracts. If this set is refined in accordance with experiential information from season to season, and if efficiency is the sole quality targeted by the highest price company A, this should in principle be reflected in the company-specific average yields. However, the sample is too small for a definitive test of this hypothesis. Also, there are other characteristics targeted by seed companies, such as honesty, important in buyback arrangements of this type where the propagated seed must all be sold back to the company under the terms of the contract. The final price at which the seed is sold is often as much as five times that offered to the grower; competition between seed companies should in principle restrict this differential to the cost of producing the breeder seed. Under these circumstances, the rewards to seed piracy are high, and seed companies maximising propagated seed received would look for a conjunction of efficiency and honesty in the growers selected.

**Table V.1**

**Tomato Seed Propagation: Yield and Revenue**

S. No.	Taluk	Village	Area (acres)	Area (units)	Seed co.	Price/Kg. (Rs.)	Yield/Unit (Kg.)	TR/Unit (Rs.)	Yield/Ac (Kg.)	TR/Ac (Rs.)
1.	Byadagi	Kadara	2.25	3.0	A	1900	29.67	56366.67	39.56	75155.56
2.	Byadagi	Kadara	0.75	1.0	C	3400	17.50	59500.00	23.33	79333.33
3.	Byadagi	Kadara	0.75	1.0	A	1900	25.00	47500.00	33.33	63333.33
4.	Byadagi	Kadara	1.50	2.0	A	1900	12.50	23750.00	16.67	31666.67
5.	Byadagi	Kolhapur	0.75	1.0	A	1900	7.50	14250.00	10.00	19000.00
6.	Byadagi	Attikatte	1.50	2.0	A	1900	39.50	75050.00	52.67	100066.67
7.	Byadagi	Ghalpuji	0.38	0.5	A	1900	45.40	86260.00	60.53	115013.33
8.	Ranebennur	Hulihalli	0.75	1.0	D	1600	30.00	48000.00	40.00	64000.00
9.	Ranebennur	Hulihalli	0.75	1.0	A	1900	14.00	26600.00	18.67	35466.67
10.	Ranebennur	Hulihalli	0.75	1.0	D	1600	23.00	36800.00	30.67	49066.67
11.	Ranebennur	Ukkunda	0.75	1.0	A	1900	33.64	63916.00	44.85	85221.33
12.	Ranebennur	Ukkunda	0.75	1.0	A	1900	47.32	89908.00	63.09	119877.33
13.	Ranebennur	Ukkunda	0.75	1.0	A	1900	42.30	80370.00	56.40	107160.00
14.	Ranebennur	Ukkunda	0.75	1.0	A	1900	40.10	76190.00	53.47	101586.67
15.	Ranebennur	Ukkunda	0.75	1.0	B	1800	30.00	54000.00	40.00	72000.00
16.	Ranebennur	Ukkunda	2.25	3.0	A	1900	30.67	58266.67	40.89	77688.89
Sum			16.13	21.50						
Avg. (Unwtd.)			1.01	1.34			29.26	56045.46	39.01	74727.28
S.D.			0.54	0.72			11.68	21889.47	15.58	29185.96

Note: Tomato seed is produced on buyback arrangements with seed companies, whose identity has been disguised.  
The natural unit of land sown to tomato seed is 30 guntas (0.75 acre).

The natural unit of area sown to tomato seed is 30 guntas, which corresponds to 0.75 acres. This is the unit with respect to which all seed companies provide seed/seedlings to the farmers. Accordingly, in what follows, the term 'unit' as used in all the input norms reported (this applies to tomato seed alone) refers to an area of three-fourths of an acre. A unit so defined was the minimum area sown to tomato seed in the sample (with one exception), and in all but four cases, also the maximum. The total area sown to tomato seed in the sample, aggregating across the sixteen farms, amounted to 16.13 acres.

Since, for whatever combination of reasons, no systematic differences are discernible between farmers selected by the different seed companies, it was decided to take a simple yield mean across all seed companies. Averaging across all seed companies, the (unweighted) mean yield per unit is 29.26 kg, and the average total revenue is Rs. 56,046. Because the higher priced C company seed had a lower yield, the total revenue obtained is close to the overall mean. Thus the average excluding the farm sown to C seed is not very different from the average including it.

Per acre, the output and revenue norms work out to 39 kgs., valued at close to Rs. 75,000.

Table V.2 presents the corresponding figures for sunflower seed propagation from a sample of 13 cultivators in four villages spanning three taluks: Byadagi, Ranebennur and Hirekerur. The aggregate area sown to sunflower for seed propagation in the sample is 30 acres, at an average of 2.3 acres per farm.

There are two types of output here. Seed of a quality acceptable to the company receives a price of Rs. 3000-3800 per quintal; once again, as in the case of tomato seed, it is impossible to identify any relationship between price and yield. Seed of either male parent lines, or of lesser quality from female parent lines, termed a by-product in the table, is bought by the company at prices ranging between Rs. 1000-1200/quintal, i.e. at the prices prevalent for sunflower as an oilseed. The average consolidated yield is 3.13 quintals/acre, corresponding to a total revenue of Rs 8460/acre, lower than that obtainable from cultivation of tomato seed by an order of magnitude.

Table V.2

## Sunflower Seed Propagation: Yield and Revenue

S. No.	Taluk	Village	Seed co.	Area (acres)	Sunflower			By-product			Consolidated	
					Price/Qntl. (Rs.)	Yield/Ac (Qntl.)	TR/Ac (Rs.)	Price/Qntl. (Rs.)	Yield/Ac (Qntl.)	TR/Ac (Qntl.)	Yield/Ac (Rs.)	TR/Ac (Rs.)
1.	Byadagi	Kolhapur	F	5.00	3800	4.00	15200	1000	0.60	600	4.60	15800
2.	Ranebennur	Hulihalli	G	1.00	3000	1.80	5400	1200	0.40	480	2.20	5880
3.	Ranebennur	Hulihalli	G	1.00	3000	2.00	6000	1100	0.40	440	2.40	6440
4.	Ranebennur	Hulihalli	G	1.00	3000	1.50	4500	1200	0.50	600	2.00	5100
5.	Ranebennur	Ukkunda	G	3.00	3000	2.50	7500	1200	0.70	840	3.20	8340
6.	Ranebennur	Ukkunda	E	1.00	3000	6.00	18000	1000	1.00	1000	7.00	19000
7.	Ranebennur	Ukkunda	G	1.00	3000	0.50	1500	1100	0.80	880	1.30	2380
8.	Ranebennur	Ukkunda	A	1.00	3800	3.00	11400	1000	2.50	2500	5.50	13900
9.	Hirekerur	Sannagubbi	G	5.00	3000	3.00	9000	1100	0.40	440	3.40	9400
10.	Hirekerur	Sannagubbi	G	4.00	3000	2.75	8250	1200	0.50	600	3.25	8850
11.	Hirekerur	Sannagubbi	G	3.00	3000	1.67	5000	1200	0.33	396	2.00	5396
12.	Hirekerur	Sannagubbi	G	2.00	3000	1.50	4500	1100	0.50	550	2.00	5050
13.	Hirekerur	Sannagubbi	G	2.00	3000	1.25	3750	1100	0.60	660	1.85	4410
Sum				30.00								
Avg. (unwtd.)				2.31		2.42	7692.31	1115.38	0.71	768.15	3.13	8460.46
S.D.						1.36	4540.88	76.92	0.55	530.00	1.59	4740.17

Note: Sunflower seed is produced on buyback arrangements with seed companies, whose identity has been disguised. Seed of acceptable quality is bought at the premium price. Seed of either male parent lines, or of lesser quality from female parent lines, termed a by-product here, is bought by the company at prices prevalent for sunflower as an oilseed.

**Table V.3**

**Chillies & Cotton: Yield and Revenue**

S. No.	Taluk	Village	Area* (acres)	Chillies			Cotton			Total TR/Acre (Rs.)
				Price/Qtl. (Rs.)	Yield/Acre (Qtl.)	TR/Acre (Rs.)	Price/Qtl. (Rs.)	Yield/Acre (Qtl.)	TR/Acre (Rs.)	
1.	Kundgol	Bilebal	64.00	3500.00	0.78	2734.38	1200.00	1.25	1500.00	4234.38
2.	Kundgol	Sanushi	21.00	3500.00	0.48	1666.67	1800.00	2.86	5142.86	6809.52
3.	Kundgol	Sanushi	24.00	3500.00	1.88	6562.50	1600.00	3.75	6000.00	12562.50
4.	Kundgol	Sanushi	3.50	3200.00	1.14	3657.14	1600.00	1.71	2742.86	6400.00
5.	Kundgol	Sanushi	3.50	3000.00	1.00	3000.00	1500.00	2.00	3000.00	6000.00
6.	Kundgol	Elewal	16.00	3500.00	0.38	1312.50	1600.00	0.11	180.00	1492.50
7.	Kundgol	Elewal	1.50	3000.00	1.0	3000.00	1500.00	0.67	1000.00	4000.00
8.	Hubli	Aralikatte	2.50	3500.00	1.60	5600.00	1600.00	1.40	2240.00	7840.00
9.	Hubli	Aralikatte	3.00	3500.00	1.00	3500.00	1600.00	0.40	640.00	4140.00
10.	Hubli	Aralikatte	4.00	3500.00	1.00	3500.00	1600.00	0.25	400.00	3900.00
Sum			143.00							
Avg. (Unwtd.)			14.30		1.03	3453.32		1.44	2284.57	5737.89
S.D.					0.43	1517.37		1.12	1888.10	2861.55

**Notes:** Chillies and cotton are traditionally intercropped in the area studied. Unlike seed propagation, the crops are sold on the open market; there is no buyback arrangement.



Table V.3 presents the yield and revenue figures for rainfed inter-cropped chillies/cotton from a sample of 10 cultivators in four villages spanning two taluks: Kundgol and Hubli. The aggregate area sown to this intercropped combination is 143 acres, at an average of 14.3 acres per farm.

The mean yield of chillies is around one quintal/acre. At a price between Rs 3000-3500/quintal, this yields an average of approximately Rs 3453/acre. The mean cotton yield is 1.44 quintals/acre, which at a price between Rs 1200-1800/quintal, yields approximately Rs 2285/acre. The total consolidated revenue is Rs 5738/acre, of the same order as for sunflower seed propagation.

How do these yields compare with those reported in other surveys? Seed propagation in general is different from cultivation for commercial purposes; the emphasis is on the quality of the seed produced, and the price for the output is correspondingly higher. Propagation of hybrid seed requires isolation of female plants from the male plants; this together with the wider spacing between plants and rows means that the plant population is lower per unit area sown.

There are no other survey data available on tomato seed propagation. Commercial production is measured by the weight of the whole crop including the pulp, so that a direct comparison is not possible with the yield in seed propagation which is measured by the weight of seed produced. The hybrid tomato strains introduced by Pepsi Foods in Punjab are reported to have trebled yields in terms of the whole crop to 32 tonnes an acre (World Bank Country Economic Memorandum, 1996:38). These high yield hybrid strains may well have been propagated in the North Karnataka region surveyed here, which with agro-climatically similar regions in Maharashtra and Uttar Pradesh has achieved prominence on the seed propagation map.

Sunflower yields however are uniformly measured by the weight of seed produced, whether for seed propagation or commercial sale. The yields in quintals reported for commercial cultivation of hybrid sunflower are as follows:

	<u>Dharwad District</u>	<u>Karnataka State</u>
1990-91	2.57	4.27
1991-92	4.37	4.27
1992-93	3.33	3.97
1993-94	3.26	3.23

Source: Department of Economics and Statistics, Government of Karnataka.

The 3.13 quintal average of the sample farms of this study is thus comparable to yields recorded in the district and the State, although the former is for irrigated acreage alone, and the latter are averaged across irrigated and unirrigated land. The farmers in the sample with very low yields of under one quintal cited water shortage as the reason for their poor performance, and said they had obtained much higher yields the previous year. The year of survey, 1995, was not a low rainfall year, so that the water shortages referred to were local failures of groundwater. These might of course be part of the worrisome general lowering of the ground water table all over the country.

For commercial production of chillies-cotton, there is a previous study covering the same region of Northern Karnataka (Hanumappa-Bhende, 1994). The estimates obtained in that study for rainfed cultivation are:

Chillies : 2.06 - 2.30 quintals/acre.

Cotton : 1.02 - 1.43 quintals/acre.

The Hanumappa-Bhende study reports that there has been a secular decline in yields for chillies in particular from 5-6 quintals/acre obtained ten year ago, because of a decline in soil quality. A major reason for this is the reduced application of organic manure, as a result of the decline in its availability consequent upon encroachment on grazing commons. The average yield obtained here of 1.03 quintals for chillies is even lower than the Hanumappa-Bhende figure, indicating perhaps a continuation of the secular decline. The cotton average of 1.44 quintals is however at the upper end of the range obtained in that study.

On balance, the yields obtained in this survey are at the low end of such comparable estimates as are obtainable elsewhere. Thus, the taxable surplus as estimated for this study will not err on the high side.

## **V.2 SURPLUS OF REVENUE OVER VARIABLE COST**

What is principally of relevance for the purposes of this study is the surplus of total revenue over total variable cost. Table V.4 presents a summary of variable costs/acre for all three crops, along with mean revenue figures from tables V.1-V.3. Subsequent tables present the constituent input norms going into the consolidated variable cost figures of

table V.4 in considerable detail. It seems possible to extract the following conclusions from table V.4:

1. Tomato seed propagation, with a mean absolute surplus of nearly Rs. 55,000/acre, is in a different class from the other two crops, where the surplus is of the order of Rs. 4-5000/acre, around one-tenth. This reinforces the case made right at the outset for a crop-specific approach to taxation of agriculture.

**Table V.4**

**Summary of Revenue and Variable Costs Per Acre**

		<b>Tomato seed</b>	<b>Sunflower seed</b>	<b>Chillies/ cotton</b>
No. of farms surveyed		16	13	10
Size of farm	Mean (acres)	1.01	2.31	14.30
	Median (acres)	0.75	2.00	3.50
Yield/acre	Mean (Kg.)	39	313	103 (chilly) 144 (cotton)
Total revenue/acre	Mean (Rs.)	74727	8460	5738
	Std. dev.	29186	4740	2862
	Coeff. of var.	0.39	0.56	0.50
Total variable cost/acre	Mean (Rs)	19855	3108	1752
	Std. dev.	1791	596	446
	Coeff. of var.	0.09	0.19	0.25
TR-TVC/acre	Mean (Rs.)	54873	5353	3986
(TR-TVC)/TR	Mean (%)	66.73	52.33	63.74
	Std. dev.	19.62	29.15	14.41
	Coeff. of var.	0.29	0.56	0.23

**Source:** Revenue and yield figures from tables V.1 to V.3; cost figures from annex tables T-13, S-13 and C-11.

2. It would be misleading to assume uniformity of returns within any given type of cultivation activity. Thus, tomato and sunflower seed propagation are both

performed on contractual buy-back arrangements with seed companies, yet the return on sunflower is more akin to that obtainable from rainfed cultivation of chillies/cotton. The difference between the results for tomato and sunflower within seed propagation on irrigated land highlights the need for finely-tuned crop specificity in establishing the taxability of crops.

3. The disparity in returns between crops coexists in equilibrium because the more profitable crop is entry-barriered by seed companies unwilling to over-reach their quality control and monitoring abilities.
4. Given such wide disparities between the profitability of different crops, it is entirely justifiable to have an enhanced land-based levy on a few selected crops, and not on others. Discrimination of this type has however to be properly substantiated and this is where the contribution of the present study lies. The object of the study is not to offer a definitive list of taxable crops, but to advance an approach by which to establish the taxability of agricultural activities not covered by standard cost of cultivation surveys. **Unless a beginning is made in a discriminatory, sequential crop-specific manner towards the tapping of agricultural surpluses for the local financing of agricultural infrastructure, any improvement in rural levels of living will remain dependent on uncertain transfers from higher levels of government, themselves constrained by the large compliance crisis in the country.**
5. Among the three crops covered in this study, it seems clearly possible to advance tomato seed propagation at existing input costs and yields as a candidate for an enhanced land-based levy.
6. Along with the difference between crops in the absolute surplus over variable cost, there is the inter-crop difference in the percentage that this surplus constitutes of total revenue. This percentage is roughly 2/3 for tomato seed propagation and chillies-cotton, but around 1/2 for sunflower with a very high coefficient of variation.
7. **Any tax scheme for agricultural income must necessarily take into account yield failure.** The probabilistic component to agricultural outcomes necessitates the identification of a yield threshold below which any presumptive levy does not apply. Table V.4 shows that the taxable highest- return crop has the lowest coefficient of variation of 0.39. This may always be so, if the underlying production function permits of minimisation of the damage caused by any given exogenous vagary by application of more inputs; but it is not necessary that it should be so for the scheme devised in this report.

8. The coefficient of variation of cost is much lower than that for revenue for each crop, and between crops is once again lowest for tomato, as low as 0.09. This once again suggests the existence of a best-practice input package which minimizes downside risk, and which is most uniformly approached for high-valued crops where the higher expected return justifies the incremental cost.
9. The variability of  $[TR-TVC]/TR$  is lower than the variability of total revenue. The relationship between  $[TR-TVC]/TR$  and yield will be explored in detail in the next chapter, which addresses the issue of the manner of specification of the final tax.
10. As already said in chapter 2, the crop-specific levy should be assigned to gram panchayats, the lowest of the three tiers in the local government structure. Willingness to comply will in principle be greater when the revenues collected are to be retained locally for improvement of local infrastructure.
11. The link between improved local infrastructure, in particular better watershed management, and higher agricultural productivity, once established, will both improve willingness to comply and expand the set of crops on which an enhanced land-based tax may be levied.

### **V.3 PHYSICAL OPERATION-SPECIFIC INPUT NORMS BASED ON OBSERVED USAGE**

In what follows, the physical input data used to generate the surplus over total variable cost (TVC) reported in table V.4 for each crop are examined in considerable detail. Farm-wise figures of observed input usage by operation are presented in annex tables T1-T13 for tomato seed, S1-S13 for sunflower seed, and C1-C11 for chillies-cotton. The general conventions adopted in respect of recording input usage were listed in the previous chapter on survey design.

Table V.5 provides a summary breakdown by major constituent of cost of cultivation for the three crops. Labour is the dominant component, accounting for between 36-58% of total expenditure (this includes imputed expenditure on family labour).

**Table V.5**

**Constituents of Variable Cost**

Input	Mean expenditure/unit area (Rs.)		
	Tomato*	Sunflower	Chillies and cotton
Labour	8688 (58.34%)	1116 (35.91%)	677 (38.64%)
Non-human energy	307 (2.06%)	340 (10.94%)	439 (25.06%)
Organic manure	541 (3.62%)	418 (13.45%)	202 (11.53%)
Seedlings/seed	297 (1.99%)	369 (11.87%)	55 (3.14%)
Chemical fertiliser	1423 (9.56%)	700 (22.56%)	374 (21.35%)
Pesticide	2240 (15.04%)	164 (5.28%)	5 (0.29%)
Other	1395 (9.36%)	0	0
<b>Total</b>	<b>14891</b> <b>(100.00%)</b>	<b>3108</b> <b>(100.00%)</b>	<b>1752</b> <b>(100.00%)</b>

**Source:** Annex tables T-13, S-13, C-11.

**Notes:** The entries for the constituent categories may not add up to the total because of rounding.

\* Person-days and expenditure are given per unit area sown to tomato (3/4 acre); per acre for the other two crops.

Aside from the categories mentioned in the table, there were no other costs such as for example on electricity or water, since irrigation is done in the area from underground water, with no charge either for the water itself nor (at the time)<sup>1</sup> for electricity. Inputs provided to farmers at subsidised prices, like nitrogenous fertilisers<sup>2</sup> and electricity, will tend to suppress variable costs of cultivation, and thereby overstate the surplus accruing to the farmer. However the share of fertiliser in total cost varies roughly between 10 to 20%, and in general looms larger for the two low-cost, low-surplus crops which are not taxable at present levels. Since it is labour cost that dominates in the higher cost, higher-valued crops, the reduction of subsidy over time should not raise costs over time much

above the annual rate of inflation. On the revenue side, the price received by farmers for their output should in turn rise over time by much above the rate of inflation, since with the opening up of the economy there would be more seed companies entering into competition with those already in the field.

The survey conducted here is designed principally as a prototype for similar surveys applied to the particular crops of relevance in each region of the country. Since labour is the principal component, and since as pointed out in Chapter IV physical norms are in any case impossible to establish with respect to fertiliser and pesticides, crop-specific surveys could perhaps focus exclusively on collecting expenditure on labour in the cultivation of different crops. Non-labour expenditure, requiring as it does cash outlay in all but a few cases (the exceptions are owned tractors and bullock carts, a minor component of cost in any case), can be collected in a consolidated "other" category, which would greatly simplify the survey required for each crop.

Table V.6 lists mean labour usage per acre for the three crops by operation. The following are the major points emerging from the table.

1. The total number of person-days required for tomato cultivation, at 423 per unit cultivated, is higher than for sunflower (60 days) and chillies-cotton (34 days) by an order of magnitude. (This is despite the fact that the tomato figures are normalised to the unit area cultivated, which is  $\frac{3}{4}$  of an acre).
2. In both the seed propagation activities, the dominant operation in terms of labour requirement is cross-pollination. When this operation is excluded, the labour input into sunflower is about equivalent to that for chillies-cotton. But for the tomato crop, even after subtraction of the 300 days required for cross-pollination, the labour requirement is still 2-4 times that for the other two.
3. There cannot be a prior expectation of uniformity in input use across crops, and indeed that is the reason why crop-specific surveys are necessary. Nevertheless, the approximate consistency in labour input across crops for the initial preparatory operations serves as a mutually reinforcing cross-check on the accuracy of the input data collected. Such variations as exist for the other operations accord with prior expectations for irrigated as opposed to unirrigated crops; and crops requiring transplanting (tomato and chillies) as opposed to crops sown directly (sunflower

**Table V.6**

**Input Norms: Mean Labour Usage**

Operation	Tomato*			Sunflower			Chillies-Cotton		
	Person-days/unit	Wage (Rs.)	Exp/unit (Rs.)	Person-days/acre	Wage (Rs.)	Exp/acre (Rs.)	Person-days/acre	Wage (Rs.)	Exp/acre (Rs.)
Land preparation	1.6	21.7	32.5	1.2	16.7	21.9	0.9	17.0	16.1
Manuring	2.7	23.1	64.0	2.1	22.7	46.9	1.0	24.0	23.2
Nursery & transplanting/sowing	14.2	17.4	248.4	4.4	17.7	77.7	8.1	18.3	146.2
Irrigation	6.9	22.8	158.5	4.3	23.5	99.5	-	-	-
Weeding	12.2	16.4	191.3	7.5	17.3	124.8	7.3	17.2	129.8
Fertiliser application	3.1	21.6	69.7	1.3	23.1	30.9	1.3	21.5	27.6
Pesticide application	6.4	23.5	144.4	1.3	23.1	28.2	0.1	25.0	1.3
Staking	27.2	24.3	655.0	-	-	-	-	-	-
Cross-pollination	301.6	20.8	6257.9	17.6	17.3	312.1	-	-	-
Watch & ward	-	-	-	5.2	19.2	100.6	-	-	-
Harvesting & processing	47.4	18.3	866.4	15.0	18.1	273.2	7.7 7.2	17.0 28.5	132.3 201.9
<b>Total observed</b>	<b>423.3</b>	<b>20.6</b>	<b>9688.1</b>	<b>59.8</b>	<b>18.6</b>	<b>1115.8</b>	<b>33.6</b>	<b>19.6</b>	<b>677.2</b>
Estimate at modal wage		20.0	8614.4		15.0	897.0		15.0	503.4
Est/observed			1.0			0.8			0.7

**Source:** As in table V.5

**Notes:** \* Person-days and expenditure are given per unit area sown to tomato (3/4 acre); per acre for the other two crops.



and cotton). The harvesting requirement is highest for the tomato crop, which matures and is picked over roughly a month (corresponding to the month-long cross-pollination period). Most of all, it is clear from the remarkable uniformity between sunflower and chillies-cotton in the labour input into weeding, and fertiliser and pesticide application and the markedly high inputs into the tomato crop for the same operations, that more care is expended on the nurturing of higher-valued crops.

4. The mean wage rate is roughly similar across the crops, around Rs 20/day, but the modal wage differs according to the gender composition of hiring (see table V.7). Since females were the predominant component of hired labour in sunflower and chillies-cotton though not tomato, the modal wage for the first two is Rs 15/day, as compared to Rs. 20 for tomato. The similarity of mean wage across crops despite the lower modal wage in two is because within each crop there are substantial wage variations by operation among female labour. Thus for example, cotton harvesting which is performed on a piece-rate of (most usually) Rs. 1.50/kg, pays a wage of Rs 30/day at a cotton-picking rate of 20 kg. per person-day. This was among the highest wage rates observed, even though for an unirrigated crop and performed exclusively by females.
5. Because of these unpredictabilities in the operation-wise wage pattern within a crop, the use of a global modal wage from prior knowledge of the gender composition of labour hire for a crop, in conjunction with survey-based observation of the physical person-day input, could lead to error margins of upto 25%. For this reason, it is necessary that all surveys for the purposes of levying a presumptive tax should collect information on not merely the physical labour input, but also on the operation-specific wage.
6. The survey focus on recording mandays ensured that the use of family labour was fully taken account of, and the corresponding imputed expenditure obtained. Where, as for the pole installation component of the staking operation for the tomato plant, the task was contracted out,<sup>3</sup> the implicit labour requirement in mandays of standard duration was obtained. These imputation procedures were adopted so as to obtain comprehensive and comparable figures across crops for both the physical input in person-days and expenditures.

Table V.7 presents the gender-wise break-up of labour input into the three crops surveyed. The following points emerge from it.

Table V.7

## Labour Input Norms by Gender

Operation	Person-days/unit area									Daily Mean Wages (Rs)								
	Tomato			Sunflower			Chillies-cotton			Tomato			Sunflower			Chillies-cotton		
	FD/unit area	MD/unit area	FD/MD	FD/acre	MD/acre	FD/MD	FD/acre	MD/acre	FD/MD	Female	Male	F/M	Female	Male	F/M	Female	Male	F/M
Land preparation	1.0	0.6	1.8	1.1	0.1	13.5	0.7	0.2	3.7	20.0	22.5	0.9	18.0	25.0	0.7	16.0	22.5	0.7
Manuring	0.2	2.6	0.1	..	2.1	0.0	..	1.0	0.0	20.0	23.3	0.9	..	22.7	0.0	..	24.0	0.0
Nursery & transplanting/ sowing	11.7	2.5	4.7	3.1	1.3	2.4	7.1	1.0	7.3	16.4	22.8	0.7	16.5	21.7	0.8	17.5	24.0	0.7
Irrigation	..	6.9	0.0	..	4.3	0.0	..	..	..	..	22.8	0.0	..	23.5	0.0	..	..	..
Weeding	12.1	0.1	121.0	6.8	0.8	9.0	7.3	..	..	16.3	18.0	0.9	16.2	23.3	0.7	17.2	..	#
Fertiliser application	0.6	2.5	0.2	..	1.3	0.0	0.6	0.7	0.8	16.7	22.7	0.7	..	23.1	0.0	16.3	25.0	0.7
Pesticide application	..	6.4	0.0	..	1.3	0.0	..	0.1	0.0	..	23.5	0.0	..	23.1	0.0	..	25.0	0.0
Staking	2.9	24.3	0.1	..	..	..	..	..	..	16.7	25.0	0.7	..	..	..	..	..	..
Cross-pollination	176.6	125.0	1.4	25.2	7.9	3.2	..	..	..	20.8	20.7	1.0	16.0	21.7	0.0	..	..	..
Watch & ward	..	..	..	5.2	..	#	..	..	..	..	..	..	19.2	..	#	..	..	..
Harvesting & processing	34.3	13.1	2.6	11.9	3.1	3.9	7.66 7.20	..	#	16.5	22.2	0.7	16.7	22.5	0.7	17.00 28.50	..	#
Total	239.5	183.9	1.3	53.2	22.0	2.4	30.6	2.9	1.3	18.3	22.7	0.8	16.7	22.9	0.7	19.1	24.0	0.8
Modal wage	..	..	..	..	..	..	..	..	..	20.0	25.0	0.8	15.0	25.0	0.6	15.0	25.0	0.6

Source and Notes: See table V.6.

1. The most notable feature is the domination of female labour in total person-days. The ratio of female-days to male-days hired is 1.3 for tomato, 2.4 for sunflower, and 10.4 for chillies-cotton.
2. Chillies-cotton on unirrigated land could indeed be described as cultivated almost exclusively with female labour. This is because the male-dominated operations like organic manuring, irrigation, and fertiliser and pesticide application, are either not performed or performed much less intensively in dry land cultivation. The principal labour requirement here is for transplanting/sowing, weeding and harvesting, which are the standard "female" operations for all the crops.
3. The cross-pollination operation which raises the demand for labour in seed-propagation also shows predominantly female hire (the ratio of female to male days is 1.4 for tomato, 3.2 for sunflower). But because of the other additional operations performed largely or exclusively by males, the female/male ratio comes down relative to dryland cultivation.
4. Wages are operation-specific rather than crop-specific. There is some gender-specificity as well, although the female/male wage ratio varies by operation. A formal ANOVA was not performed to establish the contribution of each factor to the overall variation of wages, for the following reasons:
  - a. Since this was not a wage-study, no attempt was made to calibrate very carefully the exact duration of each working day. Some of the differences between operations may quite simply reflect differences in the number of hours worked for each operation. The variation within an operation may reflect the fact that some cases of hire may have carried a task-completion clause, with a duration of more than the standard eight hours. Thus, implicit hourly wage-rates may vary much less than the observed daily wage-rates.
  - b. Since this was a study designed to capture total expenditure, each operation was not broken down into its component tasks. Had that been done, the within-operation variation would be further reduced.
5. Following from both of the above, that the ratio of female to male wages is less than one in all operations is not sufficient evidence of gender discrimination in hiring. There is enough variability in the constituent tasks within each operation and in the duration of hiring between daily wage contrasts so that the observed gender-specific daily wages do not make possible any inferences regarding unequal pay for equal work.

## **V.4 SURPLUS OVER TOTAL VARIABLE COST AS A FUNCTION OF YIELD**

For the purposes of the taxation exercise, the field survey is needed principally to generate a satisfactory estimate of the percentage of total revenue per acre that constitutes the surplus over total variable costs of cultivation [ $\% (TR-TVC)/TR$ ]. In the next chapter, the fixed costs of cultivation will further be subtracted to obtain the taxable surplus.

The threshold yield clearly needs to be identified. Use of average yield is not recommended for two reasons. One is that it exempts half or possibly more of all cultivators from the tax, and thus defeats the purpose of it. The other is that average yields fluctuate from year to year, whereas a threshold prescribed independently of the average is applicable across time, and is more fair in years or periods of declining average yield.

The farm-wise data in annex tables T-14, S-13 and C-11 on [ $\%(TR-TVC)/TR$ ] are plotted in figures V.1 to V.3 respectively against total revenue/acre rather than physical yield directly to facilitate cross-crop comparability, since for inter-cropped chillies/cotton, a consolidated physical yield is not possible.

In the two seed propagation crops, there is a distinct kink in the curve, beyond which there is no substantial increase in the surplus as a percentage of total revenue. Upto this clear threshold value of TR/acre, the surplus as a function of TR increases at a steep gradient. Beyond this threshold the % surplus of TR stabilises, with a much flatter (though still positive) gradient. Higher yields beyond the threshold are clearly obtained through more intensive application of labour and other variable inputs. The stability of the surplus percentage shows a stability of response of TR to TVC beyond the threshold, and the small positive value of the slope indicates an elasticity of response a little greater than one.

The threshold is less clearly evident for chillies-cotton, where the percentage surplus of TR does not stabilise at any point. Three alternative thresholds are tried for this crop in the tabulation below. For each crop, the average is presented alongside the threshold yield/s for comparative purposes.

FIGURE V.1

# TOMATO SEED PROPAGATION

% (TR - TVC) / TR AS A FUNCTION OF TR / UNIT

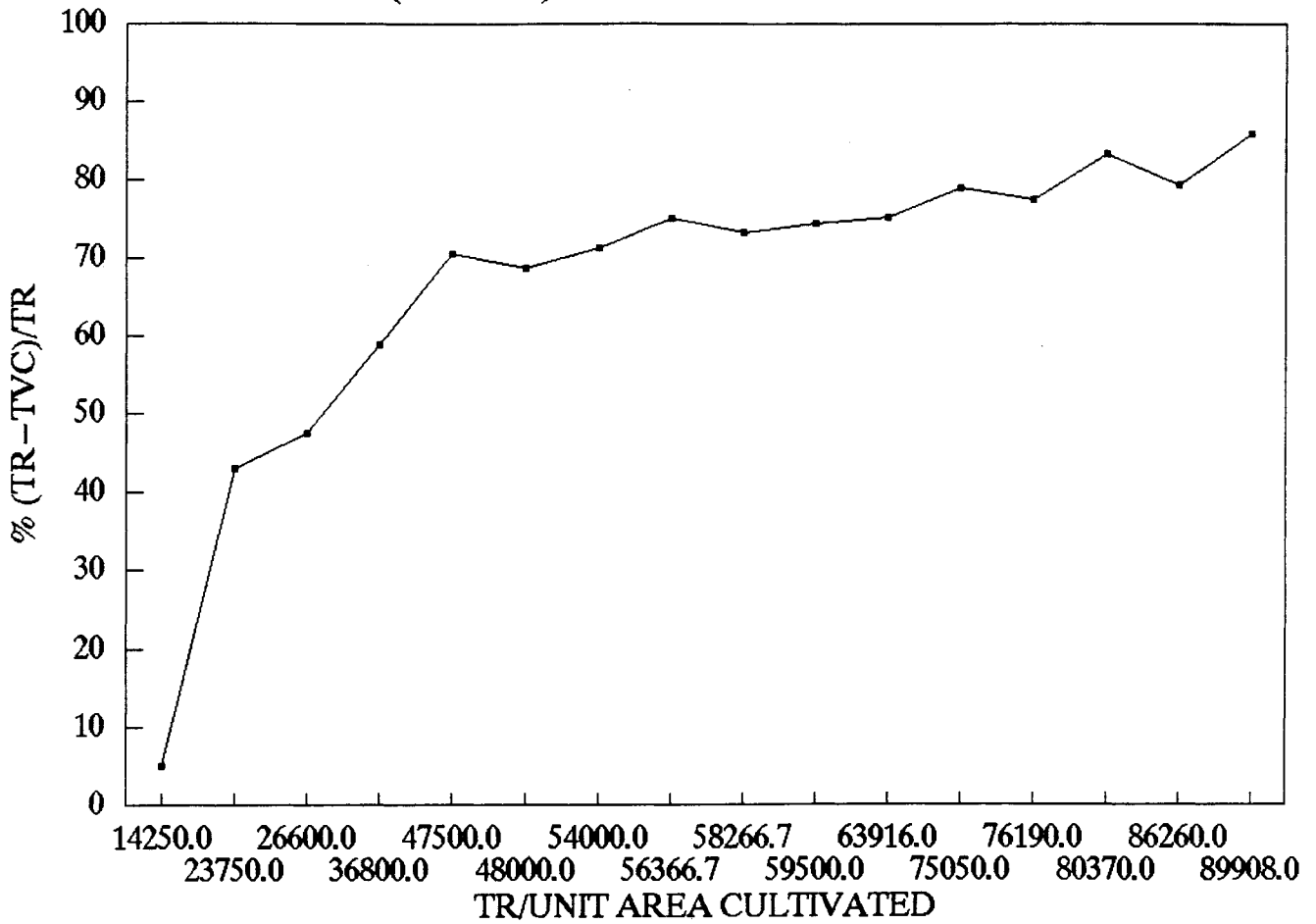


FIGURE V.2

# SUNFLOWER SEED PROPAGATION

% (TR - TVC) / TR AS A FUNCTION OF TR / ACRE

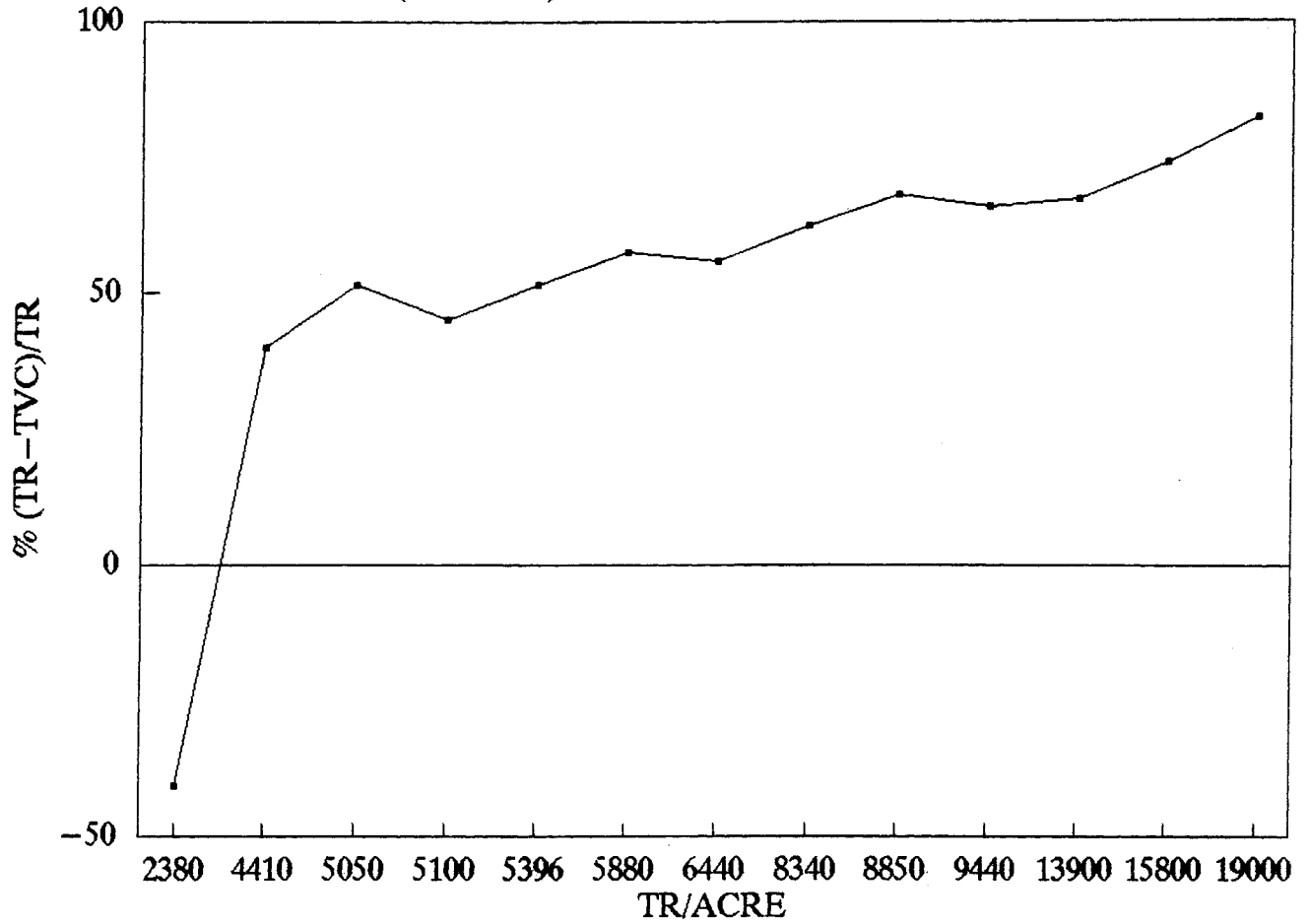
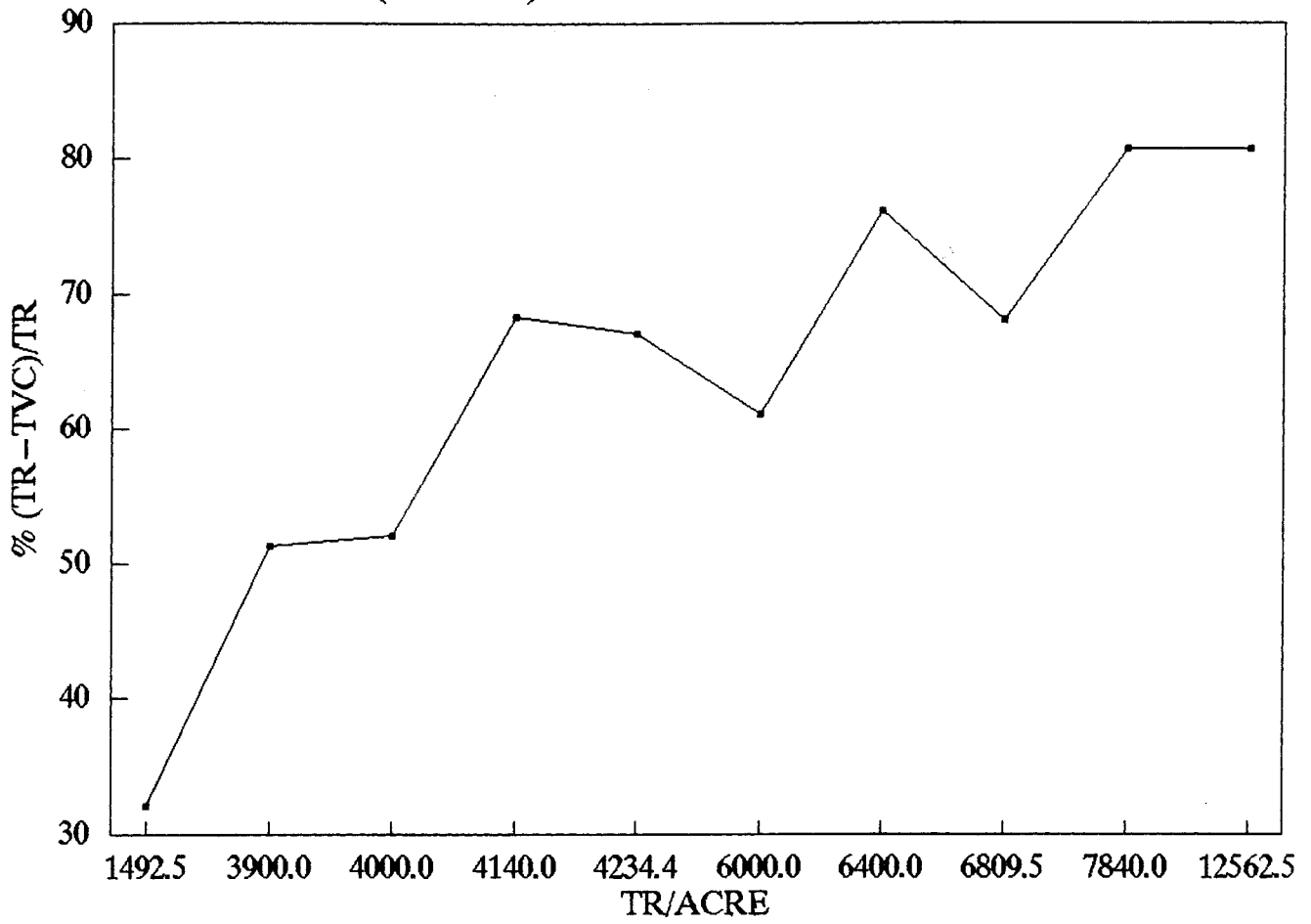


FIGURE V.3

# RAINFED CHILLIES – COTTON

% (TR - TVC) / TR AS A FUNCTION OF TR / ACRE



## V.5 CONCLUSION

An important finding of general validity emerging from the field survey is that there is *prima facie* evidence of vast differences in the surplus of total revenue over total variable cost between crops, and that these co-exist in equilibrium because of supply-side entry barriers in terms of the required soil and irrigation requirements, and within this, further entry barriers such as the oligopsonistic market structure in seed propagation. That such differences are possible survives as a general finding beyond the specifics of the particular region and crops surveyed.

The absolute surplus of Total Revenue over Total Variable Cost is higher for tomato seed propagation than for the other two crops surveyed here by an order of magnitude. Given such wide disparities between the profitability of different crops, it is entirely justifiable to have an enhanced land-based levy on a few selected crops, and not on others. Discrimination of this type has however to be properly substantiated and this is where the contribution of the present study lies. The object of the study is not to offer a definitive list of taxable crops, but to advance an approach by which to establish the taxability of agricultural activities not covered by standard cost of cultivation surveys.

There is greater uniformity between the three crops in the percentage that the surplus constitutes of total revenue. When this percentage is plotted against yield, there is in the case of the two seed propagation crops, a distinct threshold yield beyond which the surplus stabilises as a percentage of TR. The figures of percentage surplus at these endogenously generated threshold yields will be used in the chapter that follows to generate taxable income as a percentage of total revenue. These will then be used with the total revenue at the threshold yield to generate the crop-specific absolute tax liability. The scheme suggested here trades off simplicity at the expense of some regressivity among cultivators falling above the threshold yield. A levy specified at a uniform percentage of total revenue above the threshold would be more equitable, but will require information on the exact quantum of yield obtained by each cultivator and will therefore be harder to enforce.



Table V.8

Per Cent Surplus of TR/Acre at Threshold And Average Yields

	Tomato seed		Sunflower seed		Chillies-cotton	
	Threshold yield	Average yield	Threshold yield	Average yield	Threshold yield	Average yield
TR/Acre*	Rs. 47500*	Rs. 56046*	Rs. 5050	Rs. 8461	i. Rs. 4140 ii. Rs. 4234 iii. Rs. 6000	5738
Yield/acre (% of average)	25 kg.* (85%)	29.2 kg.* (100%)	2 qtl. (65%)	3.1 qtl. (100%)	i. 72% ii. 74% iii. 105%	100%
% (TR-TVC) / TR	70.48%	66.73%	51.31%	52.33%	i. 68.25% ii. 67.02% iii. 61.08%	63.74%
(TR-TVC) / acre	Rs. 33478*	Rs. 41155*	Rs. 2591	Rs. 5353	i. Rs. 2825 ii. Rs. 2838 iii. Rs. 3665	Rs. 3986

**Notes:** The implicit price from the TR and yield figures at the threshold and average may differ slightly.

Tomato Seed:

The natural unit of land sown is 3/4 acre;

Chillies-cotton:

No physical yield figures are reported because the mix of chillies and cotton obtained varies between the three revenue thresholds. The average was 1.03 quintals chillies and 1.44 quintals cotton per acre.

The yields observed in the sample surveyed, when juxtaposed against other field evidence, seems to support the fear that there has been a secular decline in yields from dryland farming in particular. The corrective action that is called for in order to stem and eventually reverse the decline in yields, whether it calls for better groundwater management or better management of common grazing land, can be effectively performed only at the panchayat level of governance. And it is for the strengthening of this very level of governance that the presumptive tax on agricultural income is proposed. Since the tax is grounded squarely and explicitly on the present reduced yields, there is no danger that it will overestimate present-day ability to pay. Eventually, with agricultural income having been raised by the productive use of the initial tax revenues, the tax could be further enhanced for subsequent rounds of improvement to agricultural infrastructure.

## NOTES

1. Karnataka is among those States that now have a nominal charge at a flat rate of Rs 100/hp. on engines used for borewell irrigation; see Chapter VI.
2. Phosphate and potassium-based fertilisers are now sold to farmers at market prices, and were at the time of field survey.
3. This was explicitly the case in 9 of the 16 farms. In the remainder, it seems to have been performed like the second component task of the operation by labour hired by the day, but from the wages reported of as much as Rs. 35/day, higher than the male modal wage of Rs. 25/day by 40%, there would seem to have been a task completion component to the daily contract as well. The implicit input in standardised mandays was obtained by applying the male modal wage of Rs. 25 to the total expenditure on pole installation for all 16 farms.

## CHAPTER VI

### RECOMMENDED RATES OF LEVY

In this chapter, fixed costs are added on as percentages of total revenue at the threshold yield rather than as absolutes, so that the prescribed tax can also be so specified, and thus be automatically indexed to changes over time in the price of the crop (the term inflation is deliberately avoided because sharp downward movements in prices of individual crops are not unknown). The total revenue at the threshold yield is easily updated each year to the current price of the crop. **It is recommended here that the levy be specified each year at the absolute sum resulting from application of the specified rate to total revenue at the threshold, payable uniformly by all cultivators above the threshold. This is recommended for its simplicity.** Alternatively, the tax can be levied at a specified percentage of total revenue to cultivators obtaining yields above the threshold; the information costs would correspondingly be greater, because the yield of each cultivator would need to be known. The approach recommended here by contrast merely requires knowledge of whether the cultivator falls above the threshold or not.

It remains only to add on fixed costs of cultivation to the variable costs of chapter V to obtain the taxable surplus as a percentage of total revenue.

#### VI.1 THE YIELD THRESHOLD

The calculations that follow build on, and therefore critically require, stability in TVC as a percentage of TR. It will be remembered that the threshold yields of the last chapter mark the yield beyond which the ratio of TVC to TR stabilises. Thus, calculation of taxability at those threshold yields carries analytical justification.

The thresholds have been generated from survey data, and call for no further validation. It is important however to reiterate that the survey here serves only as a prototype, and is derived from a small sample with limited regional coverage. Even for these very crops, the results cannot be used for another region without reference to data from cultivators in that region.

The yield threshold used in crop insurance is a uniform 80% across crops. Crop insurance is confined to a few field crops (cereals, pulses and oilseeds); it does not extend to other field crops such as sugar-cane, leave alone horticultural crops such as those studied here. It is open only to owner-cultivators who borrow working capital from the banking system. The scheme insures the full extent of the crop loan, with the premium functioning like an addition to the interest rate (2% per crop for cereals, and 1% for pulses and oilseeds). In case of yields below the designated threshold, which is 80% of a five-yearly yield average,<sup>1</sup> an indemnity is paid equal to the percentage shortfall from the threshold applied to the amount of the loan. Needless to say, fraud in crop insurance claims is rampant, because of the difficulty of verifying the yield declared by the cultivator. This reinforces the case made here for structuring the tax in such a way as to avoid any need for knowing the exact quantum of yield obtained; the scheme suggested in this report requires knowledge only of whether the yield obtained falls above the designated threshold or not.

There is no reason whatever why the threshold chosen here should necessarily conform to the crop insurance norm, since the purpose there is very different from the one here. Indeed, the very advantage of the thresholds developed here is that they are independent of yield averages. A point of comparison is useful nevertheless. Of the three crops studied here, sunflower alone has a generated threshold much below the crop insurance norm. For that reason, in the calculations that follow, an alternative higher yield is examined for sunflower along with the generated threshold of 65% of average yield (table V.8), purely for comparison purposes. For chillies-cotton, the two thresholds are the first of three listed in table V.8.

The components of fixed costs are taken in sequence in what follows.

## **VI.2 INTEREST ON VARIABLE COST**

Interest on working capital has been assumed at 15% (although the rate at the time of writing is 12.5%). For one growing season, this works out at 7.5% of TVC.

This is added on to the TVC percentages of table V.8 to obtain TVC inclusive of interest (table VI.1). It will be remembered that the TVC is inclusive of the imputed cost

of family labour.

**Table VI.1**

**TVC + Interest on Working Capital at Threshold Yields**

	Tomato	Sunflower		Cotton-chillies	
Yield threshold	25 kg.*	(i) 2 qtls.	(ii) 2.4 qtls.	Rs. 4140	Rs. 4234
(% threshold/average)	(85%)	(65%)	(77%)	(72%)	(74%)
TR at threshold	Rs.47500*	Rs. 5050	Rs. 6440	Rs. 4140	Rs 4234
% TVC/TR	30%	49%	44%	32%	33%
% (7.5% int. on TVC) / TR	2.25%	3.68%	3.30%	2.40%	2.48%
% [TVC+int.] / TR	32.25%	52.68%	47.30%	34.40%	35.48%

**Notes:** \* Tomato figures are per unit cultivated (0.75 acre), not per acre.

### VI.3 IRRIGATION COSTS

The capital cost of a borewell including a 5 hp. engine is estimated at Rs. 65,000. This figure is used to generate the estimated fixed cost of private irrigation per hour as follows:

	<b>Borewell + 5hp. pump</b>
Capital cost	Rs. 65,000
Annual fixed cost:	
Interest at 17.5%	Rs. 11,375
Straight-line depreciation over 15 years	Rs. 4,333
Electricity charges at Rs. 100 per hp.*	Rs. 500
Total cost for 700 hours of usage per year**	Rs. 16,208
Cost per hour of usage	Rs. 23.15

**Notes:** \* Electricity for irrigation is not metered in Karnataka and is charged at a flat rate per horsepower of the pumpset used.  
 \*\* It is estimated that a borewell with a 5 hp. engine can irrigate an area of 5 acres.  
 20 irrigations per acre @ 7 hrs. per irrigation = 140 hours  
 Over 5 acres = 700 hours

Using the average labour-day figures per acre of table V.6, at an eight-hour duration to each person-day, the following absolute figures are obtained of irrigation costs per acre (chillies-cotton is grown under rainfed conditions):

**Fixed cost of irrigation per acre**

	<b>Tomato</b>	<b>Sunflower</b>
Labour-days per acre (eight-hour content)	6.9*	4.3
Equivalent in hours	55.2	34.4
Cost per acre @ Rs. 23.15 per hour	Rs. 1278.0	Rs. 796.4
% of TR at threshold	2.69%	(i) 15.77% (ii) 12.37%

Notes: \* Labour-day figures for tomato are per unit cultivated (0.75 acre).

The Raj Committee provision for costs of private irrigation at 20% of the surplus of TR over paid-up costs, if paid-up costs are defined to include interest on TVC, works out to roughly 13.6% for the tomato crop, as against the 2.7% provided here. For the two sunflower thresholds on the other hand, it works out to 9.5% and 10.5% respectively, much less than the 12-16% provided here. It seems more justifiable to treat the cost of irrigation per hour as an absolute, dictated by the capital cost of borewells, since the hourly cost is not in any obvious sense a function of crop yields, or of the surplus of TR over TVC.

#### **VI.4 DEVELOPMENT ALLOWANCE**

For land that is already under cultivation, the cost of bund repair, land-levelling and other maintenance is subsumed under land preparation. However, these costs may be attached more to kharif preparation than to rabi crops like seed propagation. Also, it seemed appropriate to make an allowance for private costs of land improvement before imposing a tax that is intended to defray public costs of land and watershed development.

The Raj Committee's development allowance of 20% of the surplus after deduction of irrigation expenses, works out to 16% of the surplus of TR over TVC, subject to an absolute maximum of Rs. 1000 per holding, not per acre.<sup>2</sup> The absolute ceiling of the Raj scheme carries an in-built equity element because of the cessation of proportionality to earnings from the holding beyond a point, in keeping with the overall emphasis of the Raj

scheme on introducing progressivity into the tax system.

Government cost estimates for land and watershed development, including social forestry on marginal non-arable soils, is presently Rs. 2000/acre. If the government cost estimate is scaled down to Rs. 1000/acre for arable soils, this works out to roughly 2% of total revenue from tomato, the highest-yielding crop studied here. This percentage figure was extended to the other two crops to yield a development allowance uniform in percentage but not in absolute terms, since expenditure on private land development is a function of the expected yield on the land.

## **VI.5 LAND RENTAL**

Leasing out of land is not legally permissible in Karnataka.<sup>3</sup> The cultivators in the sample surveyed did lease in some land (see chapter IV) but the market for leasing is thin. The terms are not disclosed, and vary considerably between transactions which are in general between related parties rather than arm's length, and often link factor markets.<sup>4</sup>

The only option therefore seemed to be to adopt the procedure used in official cost of cultivation surveys, of estimating the rental value of land at 10% of gross revenue for irrigated land (and hence for tomato and sunflower seed), and at 5% for dry land (applicable to chillies-cotton). This will be uniformly applied, on all including owned land on an imputed basis.

## **VI.6 EQUIPMENT**

Rental on the major items of equipment required for cultivation, such as ploughs, harrows and hoes, is included in the hire of the bullock-pair and/or tractor for ploughing/harrowing. It will be remembered that these costs were imputed for all cultivators including those owning bullocks/tractors.

Of minor equipment, the principal item is sprayers/dusters for pesticide application, for which an explicit cost estimate has to be made. For that, and for a residual category of minor items of equipment,<sup>5</sup> the calculations are as below:

	<b>Sprayers/Dusters</b>
Capital cost	Rs. 950
Annual fixed cost:	
Interest at 15%	Rs. 142
Straight-line depreciation over 10 years	Rs. 95
Total cost for 50 sprayings per year	Rs. 237
Cost per spraying	Rs. 4.74

Using the labour-day figures of table V.6 to obtain the number of sprayings applied to each crop per acre, the following cost estimates are obtained (pesticide application is not reported for chillies-cotton):

**Fixed cost of pesticide application per acre**

	<b>Tomato</b>	<b>Sunflower</b>
Labour-days per acre	6.4*	1.3
Number of sprayings per acre	6	1
Cost per acre @ Rs. 4.74 per spraying	Rs. 28.4	Rs. 4.7
% of TR per acre at threshold.	.06%	(i) .09% (ii) .07%

Notes: \* Labour-day figures for tomato are per unit cultivated (0.75 acre).

For residual equipment, the calculations are as below:

	<b>Residual Equipment</b>
Capital cost	Rs. 950
Annual fixed cost:	
Interest at 15%	Rs. 142
Straight-line depreciation over 5 years	Rs. 190
Total cost over 20 acres*	Rs. 332
Cost per acre	Rs. 16.60

\* The average size of holding of farmers in the sample was 19.9 acres.

**Fixed cost of other equipment per acre**

	<b>Tomato</b>	<b>Sunflower</b>	<b>Chillies-cotton</b>
Cost per acre	Rs. 16.6	Rs. 16.6	Rs. 16.6
% of TR per acre at threshold	0.04%	(i) 0.33% (ii) 0.26%	(i) 0.40% (ii) 0.39%



## VI.7 COST SUMMARY

The cost components arrived at in sections VI.2 to VI.5 are summarised in table VI.2, which extends table VI.1.

Table VI.2

### Cost Summary

	Tomato	Sunflower		Cotton-chillies	
Yield threshold	25 kg. *	(i) 2 qtls.	(ii) 2.4 qtls.	Rs. 4140	Rs. 4234
(% threshold/average)	(85%)	(65%)	(77%)	(72%)	(74%)
TR at threshold	Rs 47500 *	Rs 5050	Rs 6440	Rs 4140	Rs 4234
% TVC/TR	30%	49%	44%	32%	33%
% [TVC + int.] / TR	32.25%	52.68%	47.30%	34.40%	35.48%
% Irrigation cost/ TR	2.69%	15.77%	12.37%	-	-
% Development allowance/TR	2.00%	2.00%	2.00%	2.00%	2.00%
% Land rental/TR	10.00%	10.00%	10.00%	5.00%	5.00%
% Equipment cost/TR	0.10%	0.42%	0.33%	0.40%	0.39%
% Total cost/TR	47.04%	80.87%	72.00%	41.80%	42.87%
% [TR-TC]/TR	52.96%	19.13%	28.00%	58.20%	57.13%
[TR-TC]	Rs 25156 *	Rs 966	Rs 1803	Rs 2410	Rs 2419

Notes: \* Tomato figures are per unit cultivated (0.75 acre); all other figures are per acre.

The percentage surplus after addition of fixed costs is of the same order for tomato and chillies-cotton, between 53-58%. It is much lower for sunflower, at 19-28%, because this is an irrigated crop carrying all the costs of irrigation but yielding total revenue of the same order as unirrigated chillies-cotton. The sunflower absolute surplus over total cost is even lower than for unirrigated chillies-cotton. This bears out and justifies the crop-specific approach adopted in this study.

## VI.8 SUGGESTED RATES OF LEVY

In what follows the surplus of TR over TC for the three crops worked out in table

VI.2 are used to generate the percentage rates of levy implicit in present land revenue rates (table VI.3). Thereafter, higher alternative rates of levy are examined for their revenue implications.

**Table VI.3**

**Suggested Rates of Levy Per Acre**

	Tomato	Sunflower		Cotton-chillies	
Yield threshold	25 kg. *	(i) 2 qtls.	(ii) 2.4 qtls.	Rs. 4140	Rs. 4234
(% threshold/average)	(85%)	(65%)	(77%)	(72%)	(74%)
TR at threshold	Rs 47500*	Rs 5050	Rs 6440	Rs 4140	Rs 4234
[TR-TC] at threshold	Rs 25156*	Rs 966	Rs 1803	Rs 2410	Rs 2419
% [TR-TC]/TR	52.96%	19.13%	28.00%	58.20%	57.13%
Land revenue zone	V	V		V	
Land category	Garden	Garden		Dry	
Max. rate of land revenue (per acre)	Rs 16.27	Rs 16.27		Rs 3.64	
incl. of 75% cess	Rs 28.47	Rs 28.47		Rs 6.37	
Maximum land revenue/ [TR-TC]	0.05%	1.68%	0.90%	0.15%	0.15%
incl. of 75% cess	0.08%	2.95%	1.58%	0.26%	0.26%
<b>Suggested rates of levy on [TR-TC]</b>					
a. Rate (% of TR-TC)	0.50%	0.50%	0.50%	0.50%	0.50%
Total tax payable	Rs125.78*	Rs 4.83	Rs 9.02	Rs 12.05	Rs 12.05
Suggested/present levy incl. cess (if > 1)	5.89	..	..	1.89	1.89
b. Rate (% of TR-TC)	1.00%	1.00%	1.00%	1.00%	1.00%
Total tax payable	Rs251.56*	Rs 9.66	Rs 18.03	Rs 24.10	Rs 24.19
Suggested/present levy incl. cess (if > 1)	11.78	..	..	3.78	3.80
c. Rate (% of TR-TC)	5.00%	5.00%	5.00%	5.00%	5.00%
Total tax payable	Rs1257.8*	Rs.48.30	Rs.90.15	Rs.120.50	Rs.120.95
Suggested/present levy incl. cess (if > 1)	58.9	1.70	3.17	18.92	18.99

Notes: \* The tomato figures are per 0.75 acre; the suggested levy is blown up to a per acre basis before obtaining the ratio to the present land revenue rates.

Land revenue rates vary by zone and land category (table III.1). The rates used below are the maximum applicable on the relevant category of land in the region studied. The relevant category is garden land for tomato and sunflower; dry land for chillies-cotton. The region studied lay in zone V of Dharwar district, with the exception of one taluk (Hirekerur for seed propagation) which lay in zone IV. Since the zone V garden land rates are much higher than zone IV rates, these are the ones used. It will be recalled that actual rates of land revenue paid are in general much below the standard rates of table III.1 (see notes to the table).

It must be remembered that land revenue is an annual levy per acre. In working out the implicit rate of levy on a particular crop grown in a particular season, the ascription of the tax entirely to that crop imparts an upward bias to the rate of levy. On multiple-cropped land, the rate implicit in land revenue paid would be far lower (aside from the fact of the land revenue figures used here being maxima rather than actuals).

Three possible rates of levy for a crop-specific enhancement are examined for their revenue implications: 0.50%; 1%; and 5%.

On the basis of the rates of levy implicit in present land revenue rates, sunflower is the least justifiable candidate for taxation, since the present rates are already between 1.6-3% of surplus over total cost. For tomato seed, the maximum rate of present levy inclusive of cess amounts to a mere 0.08% of surplus over total cost. A 1% rate of levy on tomato implies a nearly twelve-fold increase in the amount payable. Even chillies-cotton, if taxed at 1%, would yield revenue nearly four times that of the present levy inclusive of cess. Even at a 0.5% rate of levy, the revenue increase factors are 6 and 2 respectively. These figures yield rough orders of magnitude of the revenue increase possible. The surplus from sunflower is too low for it to qualify for an additional levy, at either of the two thresholds tried.

The absolute amount so obtained is then payable by all farmers above the yield threshold. This carries some regressivity, but it is far preferable to a rate structure which requires information on the actual yield obtained by each cultivator.

The survey should provide for each crop the following parameters which can be retained as constants for future years:

**Y** : Threshold yield, specified in physical units per acre (or other land unit).

**f<sub>y</sub>** : [TR-TC]/TR at Y

Using the above parameters, the absolute levy can be worked out for any current year, c, as follows:

i.  $TR_y^c = Y \times p^c$

where for current year, c

$TR_y^c$  = total revenue at threshold yield.  
 $p^c$  = price of crop.

ii.  $L^c = r \times f_y \times TR_y^c$

where for current year, c

$L^c$  = absolute levy payable per acre (or other land unit)  
 $r$  = rate of levy, as a % of [TR-TC].

The following caveats need to be borne in mind:

1. When land revenue is collected independently of the enhanced crop-specific levy, the land revenue should be deductible from the enhanced levy payable.
2. Actual land revenue paid is in most cases far lower than the maximum rates used to generate the revenue increase factors of table VI.3. Thus the tax should not be expressed as a factor applicable to land revenue (12 times or 4 times at a 1% rate of levy for example) but as an absolute amount obtained each year from the price at which the crop is sold.
3. Because the crops selected for an enhanced levy in the first instance would consist of commercial crops, either traditional or sunrise, there is no need to apply a marketed surplus percentage to total production. But for food crops that will be necessary.
4. Because the approach adopted here exempts in all years those cultivators not reaching the stipulated threshold, there is no further need to stratify the enhanced levy payable by soil quality. What matters is the yield attained. Soil selection is in

any case implicit in the crops selected for an enhanced levy.

5. The supplementary levy is applicable only to those farmers obtaining yields in any year above the stipulated thresholds. It is pointless to use numbers from the survey conducted here to generate the percentage of cultivators falling above the threshold, for this percentage would vary from year to year.

## NOTES

1. Calculated separately for each taluk.
2. For the three crops here, that implies rates on a base of total revenue of 10.84% (tomato); 7.57% and 8.43% for sunflower; and 10.50% and 10.32% for chillies-cotton. The absolute ceiling on the development allowance implies a ceiling on the surplus over paid-up cost per holding of Rs. 6250, beyond which the development allowance bore no proportionality to the surplus.
3. With effect from March 1974, under the 1973 amendment to the Land Reforms Act of 1961, with exceptions for special categories of land owners such as personnel in the armed forces and merchant navy.
4. The only land leasing contract among the sample surveyed whose terms were reported involved an interest free loan from the lessee to the lessor for Rs. 10,000 in exchange for 2 acres of irrigated land. At a 25% rate of interest, this works out to a rental of Rs. 1250/acre.
5. Crowbars, pick-axes, sickles, seed-drills, spades, water pipes and baskets.

## **CHAPTER VII**

### **SUMMARY AND RECOMMENDATIONS**

The power to tax agricultural income has been vacated by the Central government in favour of State (then Provincial) governments ever since the Income Tax Act of 1935, on the advice of the Todhunter Committee.

That space continues to remain largely unfilled. Should it be filled at all? Traditional prescription in favour of agricultural taxation as a means of resource transfer out of agriculture has been discarded in practice in the developing world in favour of import-protected industrialisation and other less transparent means of resource transfer, accompanied by appeasement of agriculture with input and credit subsidies. With economic reform and the dismantling of this structure of implicit taxation and partially compensating input subsidies, the case for an explicit tax on agriculture resurfaces, with however a new emphasis on, and need for, retention of resources so raised within the sector for infrastructure development and productivity-enhancing land improvements. If there is no longer a need for resource flow out of agriculture into industry, it is at the same time unlikely that there will be much of a reverse flow into agriculture. The resources for agricultural development will have to be internally generated, within agriculture itself.

All States with a few exceptions levy land revenue, which has lapsed over the years into revenue-insignificance and accounts for a mere 1.4% of aggregate taxes collected by State governments. The agricultural income tax accounts for another 0.4% of total taxes collected by State governments, but is found only in those States with plantations, since it is organised agriculture alone that can maintain books of accounts in the form required for a conventional tax based on self-declared income. In Karnataka, where both taxes are levied, the share of each has been between 0.20-0.25% of State Domestic Product originating in agriculture, although with the phased freeing of coffee plantations starting December 1992 from compulsory sales at controlled prices to the Coffee Board, as a part of structural reform, collections from the agricultural income tax have risen substantially. This bears out the need for a fresh examination of possibilities for agricultural taxation

following structural adjustment and the freeing of agricultural prices from pre-reform sectoral repression.

This report does not recommend any fundamental overhaul of the structure of land revenue rates presently in place, unlike the Raj Committee, the only major official attempt to devise a scheme to tax agriculture, which suggested a nationally uniform substitute for the land revenue. However, since one of the reasons for State government indifference to land revenue is that it is shared partially or totally with panchayats, and since local indifference to collections arises because sharing is most usually not by jurisdiction but by some equity-based formula unrelated to collections, this report recommends that powers of levy of land revenue be transferred to panchayat level, with jurisdictional retention of revenues so raised. This will generate endogenous pressure for upward revision of land revenue rates.

This report also recommends a supplementary crop-specific levy in addition to the land revenue, also land-based and levied by panchayats, to be applied selectively to land sown to crops known to be the most profitable in each area. Jurisdictional retention holds the key to success in inducing voluntary compliance with such a tax. It is essential that the uses to which the revenues are put are visible and enable downward accountability to the taxpayer, as a substitute for the upward accountability ensured by present systems of auditing and control.

Any viable tax on agriculture can only be a presumptive land-based levy. A conventional tax based on self-declaration is unsuitable for the non-plantation agricultural sector, where the lack of standard account-keeping and the prevalence of cash transactions make verification of self-declaration impossible. Presumption should in principle be legally acceptable in the context of agriculture, even if not for other sectors. On economic theory grounds, presumption in any sector carries a clear efficiency advantage.

Land revenue as presently levied, in all its regional diversity in terms of design, is fundamentally a presumptive levy. It is related in principle to average returns to the land. The actual relationship between levy and land productivity may be seriously lagged, inadequately stratified, or otherwise deficient, but the principle underlying the levy has

always, historically and presently, been the productivity of land. There is also in Karnataka as well as other States a presumptive option to the agricultural income tax, in the form of progressively slabbed specific rates per hectare based on average income, in place of self-declared income actuals. Thus the principle of presumption in agricultural taxation is known and currently on offer, and a more widely-based presumptive scheme for taxation of profitable crops or activities should not be unacceptable in conception.

The case for supplementary levies on a selected subset of crops is predicated on the assumption that returns to cultivation are not equalised by cropping pattern shifts, even within a homogeneous agro-climatic region. Any of a number of barriers to entry, ranging from soil requirements to insufficiency of irrigation or credit can prevent factor shifts to the most profitable crop in a region. With the reform of the Indian economy starting in 1991, it is expected that new agro-based activities ranging from export of cut flowers to seed propagation will be the new "sunrise" sector in agriculture. These activities are likely to be especially entry-barriered because of the need for tie-ups with buyers, who tend to limit their engagement so as not to over reach their monitoring and quality control capabilities. The Bagchi proposal for implication of the Raj Committee AHT was based on the rateable value of major crops in each area, and one of the advantages suggested by the author for such an approach is that it carries an incentive to move into the designated crops from those yielding lower returns. Such an assumption can be seriously inequitable in the agriculture context. No matter how narrowly regions are delineated, there is sufficient variation within any region in soil quality, even within irrigated/unirrigated strata, that such freedom cannot automatically be assumed.

There cannot be any national uniformity in the crops chosen for taxation nor indeed should such uniformity be sought. The purpose of such a tax is to enable public provision of productivity enhancing improvements to agricultural infrastructure, so that failure to implement the tax can only be a local decision with implications that, in the first instance, will be local rather than national.

A land-based tax bears clearer jurisdictional markers than a tax on output or exports of the kind advanced by Hoff, 1993. Since the incidence of an output tax falls in long-run competitive equilibrium on the consumers of agricultural products in proportion to their consumption, an output tax is more a means of resource transfer into agriculture, rather



than a replacement in any sense for the within-sector generation of revenues that a well-designed land tax makes possible.

Any design of a scheme for agricultural taxation can only be set in the context of a particular State. The State chosen for this study is Karnataka, where the sectoral share of agriculture in State Domestic Product at one-third is slightly above the national average. Although the details of the scheme suggested are for a particular regional context, the numbered policy recommendations that follow in sections A, B, C and D are of perfectly general validity; section E presents the findings of the survey conducted in Karnataka.

## **RECOMMENDATIONS**

### **A. Overall Structure of the Scheme for Agricultural Taxation**

#### ***A.1. Retention of land revenue:***

The land revenue must be retained. In States where it has been repealed, as in Haryana, it should be reintroduced, even if only at the low rates last prevailing. The principle that all cultivators must contribute something to the public exchequer must be firmly established, even if the levy is so low as to be seen more in the light of a user charge for maintenance of land records.

#### ***A.2. Supplementary crop-specific levy:***

i. The land revenue should be supplemented by a crop-specific presumptive levy, also land-based, but related on the basis of field surveys to crop yields by way of net income.

ii. The land revenue should be deductible from the supplementary levy payable.

#### ***A.3. Powers of levy:***

i. Both the basic land revenue and the crop-specific supplementary should be levied at panchayat level. Levy of the crop-specific supplement is quite simply not feasible at higher levels of government. The information costs for a land-based levy are a direct function of the distance between government and the governed.

ii. This report does not recommend independent powers of concurrent levy for State and panchayat level governments on agricultural income, because that leaves neither level of government with adequate control over the total tax burden imposed.

**A.4. No merger with income tax:**

The crop-specific supplementary levy is not designed for merger with the Central income tax. It is also not designed for merger with the agricultural income tax, which applies to the organised large-scale end of agriculture, and is therefore best levied by State governments rather than local government.

**A.5. Obligatory/optional:**

The devolution to panchayats of the power to levy land revenue must not imply the power not to levy land revenue in its present form. Land revenue must remain an obligatory tax levied at prescribed rates at a minimum, so placing a floor on downside variability. The structure of rates should at all times remain uniform within a State, so that spatial variations in the minimum are a function only of variations in the basic levy, with panchayats given the freedom to levy or not levy additional crop-specific levies of the type recommended in this report. Thus, the basic land revenue must be obligatory, but the crop-specific supplement can remain optional.

**A.6. Jurisdictional retention of revenues:**

Local retention of the revenues so raised, for improvement of local agricultural and other infrastructure, is essential for compliance with a tax on agriculture.

**B. The Land Revenue**

**B.7. Rate structure:**

The basic land revenue can initially be left untouched in terms of its rate structure. However, pressure for upward revision of land revenue rates should be endogenously generated through transfer of powers of levy of the land revenue to panchayats.

**B.8. Powers of collection:**

Transfer of powers of levy to panchayats need not necessarily be accompanied by transfer of the revenue collection function. Judgement on the relative revenue collection

efficiency of different levels of government can only be empirically driven, and does not permit of resolution based on a priori arguments. There is already in place a State government administrative network for collection of land revenue, a network that can continue to be used if necessary until the panchayat administrative apparatus is suitably strengthened.

***B.9. Land records:***

Even where, as is recommended in this report, the power to levy agricultural taxes is given to the panchayat level of governance, the maintenance of land records must remain the rightful preserve of State governments. This is especially important in India where there are no formal titles to land ownership other than the land records maintained by the village-level official who is at present a State government functionary. This arrangement will have to remain in place for the foreseeable future, so that local records are not corruptible by local power structures, as has repeatedly happened historically in India.

***B.10. Presumptive principle:***

The basis of land revenue varies over the country according to the system of land settlement in the colonial era; in regions where intermediaries were eliminated, the subsequent settlement of land revenue rate on individual cultivators was often ad hoc or negotiated. Where it is not at hoc, there is an underlying intent to relate the land revenue to land productivity, either explicitly through crop yields or implicitly by way of soil stratifications, although neither the quantum nor the structure of present-day levies need bear any relationship to present-day patterns of land productivity. Very importantly from the point of view of this study, there are some States where there are flat rate crop-specific cesses on acreage sown to commercial crops, superimposed on the basic levy.

In some States such as Karnataka, there is a presumptive option to the agricultural income tax, which is a conventional income tax based on self-declaration, levied on the organised plantation end of agriculture.

The presumptive principle in the agriculture context is thus known, and currently on offer in some parts of the country, and a more widely-based presumptive scheme for taxation of profitable crops or activities should not therefore be unacceptable in

conception.

## **C. Supplementary Crop-Specific Levy**

### ***C.11. Need for field surveys:***

It is necessary that the new crop-specific supplementary levies should be based on field surveys, both because there are no standardised sources of information on "sunrise" agricultural activities, and because standard sources even where available do not provide any information on the stability across cultivators of norms with respect to cost as a percentage of total revenue. To underline the need for field surveys the report presents detailed findings from a field survey conducted in Northern Karnataka, covering three crops, as a prototype of the kind of exercise necessary.

### ***C.12. Variable and fixed costs of cultivation:***

The field survey is needed principally to generate stable norms for variable costs of cultivation on a crop-specific basis. Fixed costs are of their nature not crop-specific, and have to be independently developed and added on to the variable cost norms generated from the survey, although data on variable input usage are needed for apportionment of fixed costs by crop. The survey conducted here was confined to variable costs alone. The cost assumptions underlying the fixed cost calculations are presented in detail, and are readily extendable to other crops as they stand with alterations of the relevant parameters if necessary.

### ***C.13. Stability of TVC/TR:***

The survey data need to be examined for cross-sectional stability in total variable cost (TVC) as a function of observed yield, and hence observed total revenue (TR). Even if there is stability in the underlying relationship between TVC and the targeted yield, stability with respect to observed yield will obtain only if there is reasonable conformity between targeted and observed yields. This conformity would not exist at very low levels of observed yield, nor possibly at very high levels. Thus, stability in TVC/TR may reasonably be expected only above some threshold yield (TR), below which observed yield is too low to fall within the targeted range.

**C.14. Taxability criteria:**

i. If there is no stability in TVC/TR within any segment of the range of yields observed, the crop/activity is not taxable on a presumptive basis.

ii. The second criterion for exclusion from the set taxable crops of course is too low a surplus over total cost, i.e. (TR-TC).

**C.15. Catastrophe-exemption threshold**

i. If there is a clearly identifiable threshold defining the lower limit of the stable cost domain, this then serves as a catastrophe-exemption yield, below which the cultivator will be exempt from having to pay the tax. The operational advantage of a taxable threshold so obtained is that it is independent of yield averages and therefore does not need redefinition over time.

ii. An exemption provision eliminates the risk element that land taxation introduces into net farmer income, although it does not eliminate the burden on the current generation resulting from capitalisation effects of the land tax.

**C.16. Levy specification per acre:**

The presumptive crop-specific supplementary levy recommended here is specified per acre sown to a particular crop, not with respect to total income from a crop aggregating across acreage sown to it. Following from this, there is no acreage threshold. The taxable threshold is specified in terms of crop yield per acre, a readily observable indicator, rather than net income, which is not readily observable. Thus, the scheme proposed here is very different from the Raj Committee AHT, which was a scheme for taxation of the consolidated taxable income of each holding, with a corresponding threshold in terms of taxable income of the holding, which translated essentially into region-specific size-of-holding thresholds.

**C.17. Equity:**

Inter-crop equity is ensured by the two-stage procedure recommended here, whereby the selection of crops forwarded by the local bodies for consideration accords with the local ordering in terms of profitability, and the technical survey following defines a further subset based on objective evidence. Progression is implicit in the scheme, since

only those crops which yield higher returns (and which are clearly entry-barriered because of factor-specificity such as special soil requirements or other reasons, so that the disparity persists in equilibrium) are subject to the enhanced levy.

**C.18. Survey-based parameters:**

The survey should provide for each crop the following parameters which can be retained as constants for future years:

Y : Threshold yield, specified in physical units per acre (or other land unit).

$f_y$  :  $[TR-TC]/TR$  at Y

**C.19. Annual update of absolute levy:**

Using the above parameters, the absolute levy can be worked out for any current year, c, as follows:

i.  $TR_y^c = Y \times p^c$

where for current year, c

$TR_y^c$  = total revenue at threshold yield.  
 $p^c$  = price of crop.

ii.  $L^c = r \times f_y \times TR_y^c$

where for current year, c

$L^c$  = absolute levy payable per acre (or other land unit)  
 $r$  = rate of levy, as a % of  $[TR-TC]$ .

**D. Supplementary Crop-specific Levy: Operational Issues**

**D.20. Agency for conducting field surveys:**

The technical expertise for conducting the field surveys will be available only at State level, so that there will have to be a process whereby the District Planning Committees (which have been mandated under the 74th Constitutional Amendment to co-ordinate urban and rural development at district level), forward to the State government an initial list of agricultural activities for survey. Whichever among these proves to be taxable will then be the first to be implemented.

***D.21. Phasing of implementation:***

Since field surveys are time-consuming, a supplementary levy of this type can only be implemented in a sequential manner, with an initial focus on the crop/s known to be most profitable in each area.

***D.22. Requirements for operational success:***

i. Two critical requirements for any agricultural taxation scheme to succeed are minimal information costs for assessment purposes consistent with equity, and a systematic exemption provision for idiosyncratic crop failure, as distinct from non-idiosyncratic yield failure covering an entire region. The only recurring information required for assessment purposes in the scheme suggested here is a listing of cultivators growing each of the crops in the selected subset, and identification of those in each list whose yields fell below the stipulated exemption threshold.

ii. A distinction has to be made between the field survey initially required for the generation of crop-specific norms, and recurring information requirements.

iii. Even limited information of the type called for here is obtainable only locally, which is why the crop-based supplementary levy is feasible only at panchayat level.

iv. The second critical requirement for any agricultural taxation scheme to succeed is a systematic exemption provision for idiosyncratic crop failure, as distinct from non-idiosyncratic crop failure covering an entire region. The nature of the threshold provision developed here has already been described. The absence of any such provision, inherent in the Raj Committee computation of holding income from average regional crop yields, was a major shortcoming of the Raj Committee AHT.

***D.23. Annual assessment:***

The frequency of assessment of the supplementary levy designed here is annual but no information is required on the complete cropping pattern of every cultivator each year. Such information is impossible even for local-level governments to collect. The Raj Committee recommendation of an Agricultural Holdings Tax failed to find acceptance because among other things it was too information-intensive, requiring information every year on the current cropping pattern of each holding. A move to quinquennial assessment

in that scheme, or the Bagchi version, would only exacerbate the inequity inherent in a levy of that type applied comprehensively to all crops based on average yield.

***D.24. Minimising information costs:***

In a bid to minimise information costs, a simple single-rate structure is recommended in this report, not fine-tuned or even slabbed with respect to yield levels above the threshold, so that no information is required on the exact quantum of yield of each taxable cultivator. Experience with the crop insurance scheme, where the indemnity paid is a function of the percentage shortfall from the threshold yield, shows that any scheme which requires information on exact quantum of yield is an invitation to fraudulent reporting.

**E. The Karnataka Field Survey: Findings**

***E.25. Crop-specific presumption:***

The stratification of land revenue in Karnataka by type of land is essentially crop-based. Thus, presumption by type of crop of the type suggested in this report is in line with the pre-existing basis of stratification of land revenue rates. Karnataka is also among the States offering a presumptive option to the agricultural income tax on plantations, called a "composition scheme", under which progressively slabbed flat levies per acre may be paid as an alternative and independently of actual production.

***E.26. Region and crops:***

i. The field survey of three commercial crops was conducted in Dharwad district of Northern Karnataka in June-July 1995. The data relate to the agricultural year 1994-95. Of the three, two are "sunrise" seed propagation crops cultivated through bilateral tie-ups between growers and seed companies: tomato and sunflower, which require irrigated land in otherwise dry conditions. These conditions are found in Northern Karnataka. The third is intercropped chillies-cotton, traditional commercial crops grown under unirrigated conditions.

ii. Although food crops were not among those surveyed, the approach can easily be adjusted to accommodate the marketed surplus factor. The approach can and should be further extended to non-cultivation primary activities like livestock-rearing and



shrimp farming, where there is prima facie evidence of taxability.

***E.27. The sample:***

The samples selected were very small, and serve as no more than a prototype for the kind of survey required: 16, 13 and 10 farms respectively for tomato, sunflower and chillies-cotton.

***E.28. Imputation of family labour:***

Family labour is imputed, unlike the Raj Committee approach which explicitly recommends that savings on hired labour costs from use of family labour constitute a part of taxable family income. The reasons for including the imputed cost of family labour are as follows:

i. Any expectation of cross-sectional stability in input norms in cultivation can only relate to the total labour requirement, not the hired component alone. Variability in total factor use can in principle be thought of as endogenous to the enterprise; variability in hired factor use is a function of in-house availability, which is exogenous in the short-run (and there is no case for setting up adverse incentives for expanding family labour supply in the medium-term).

ii. Since wages of agricultural labourers are not taxable, the equivalent return to family agricultural labour should also be non-taxable. Returns to agriculture should be computed only after deduction of such non-taxable components.

***E.29. Imputation of other inputs:***

Other owned inputs are also imputed since, for a crop-specific approach such as this, it is immaterial whether the input involves a cash outlay or foregone income.

***E.30. Crop-specific threshold yields:***

i. The data identified clear thresholds for both tomato and sunflower seed. Plots of % surplus over TVC  $[(TR-TVC)/TR]$  as a function of yield exhibited a sharp kink, beyond which the % surplus stabilised. A single threshold was less clearly identifiable for chillies-cotton, which is grown under rainfed conditions where there would in principle be much greater variability between targeted yield and actual (observed) yields. Two options

were used for this crop to generate taxable income.

ii. The thresholds so identified call for no further validation, and can be retained as physical constants over time. The advantage of so doing cannot be over-emphasized. It is especially important not to link the threshold to a yield average, five-yearly or otherwise, as in the case of the crop insurance threshold which is expressed as a uniform 80% of average yield for all crops.

iii. For intercropped crop pairs or triplets, of which chillies-cotton is an example, the threshold cannot be specified in a single physical unit. The constituent physical units of the total revenue thresholds are indicated alongside.

iv. The thresholds are as follows (the percentage to the yield average from the sample is indicated in parentheses):

	Yield threshold (% of average)	
Tomato seed	25 kg./0.75 acre *	(85%)
Sunflower seed	2 qtls/acre	(65%)
Chillies-cotton	(i) Rs. 4140/acre (1 qtl. chillies + 0.4 qtl. cotton)	(72%)
	(ii) Rs. 4234/acre (0.78 qtl. chillies + 1.25 qtl. cotton)	(74%)

\* The natural unit of land sown to tomato seed in the region studied.

### ***E.31. Taxability criteria: stable norms***

Although the calculations were performed for all three crops, inter-cropped chillies-cotton is excludable from taxability on the grounds that the relationship between TVC and observed yield (TR) is not sufficiently stable beyond any identifiable threshold so as to serve as a basis for a presumptive levy. The same may well be found to hold for all commercial crops grown under rainfed conditions, where there is a large stochastic element to actual (observed) yield.

### ***E.32. Fixed costs:***

i. Fixed costs were calculated on the basis of explicit cost assumptions, in conjunction with input usage norms generated from the field survey. These were then

estimated as a percentage of TR at the identified threshold yield.

ii. The major items of fixed cost were land rental and development allowance for all three crops; and irrigation for tomato and sunflower. Rental of bullocks and tractors was included in variable costs.

iii. Land rental was estimated at 10% of total revenue for irrigated land, 5% for unirrigated land, in accordance with practice in cost of cultivation surveys. There was no other alternative because leasing of land is banned in Karnataka, with the illegal market in leasing thin and the terms often not arm's length.

iv. The development allowance, for overheads on repair and maintenance, was also estimated at a uniform 2% of total revenue for all three crops, without the absolute cap of the Raj Committee AHT whose principal purpose was to ensure progressivity by size of holding.

v. Irrigation costs per hour were built up from estimated costs of equipment. This in conjunction with estimates from the field survey on number of hours of irrigation applied yielded irrigation costs as a percentage of total revenue. This is in contrast to the Raj Committee approach of estimating irrigation at a uniform percentage of total revenue.

***E.33. Surplus over total cost at threshold yields:***

The results more than bore out the assumption of diversity in returns to agriculture. After addition of fixed costs to variable costs of cultivation, the percentage of surplus over total cost at the identified thresholds are as follows:

	Threshold yield: Y	% (TR-TC) / TR: $f_y$
Tomato seed	25 Kg./0.75 acre	53%
Sunflower seed	2 qtls./acre	19%
Chillies-cotton	(i) Rs. 4140/acre	(i) 58%
	(ii) Rs. 4234/acre	(ii) 57%

***E.34. Implicit rate of levy of land revenue:***

The absolute figures for (TR-TC) at the threshold yields were used to generate the percentage rates of levy implicit in present land revenue rates, keeping in mind that these

will be biased upwards for the following reasons:

- a. The standard land revenue rates used are maximum rates. Actual land revenue paid is in most cases far lower than the maximum rate.
- b. The entire burden of an annual levy is in effect being ascribed here to a particular crop grown in a particular season.

Even so, the implicit rates of levy calculated at the threshold yields are very low; for higher yields, the rates would be lower still:

**Implicit rates of levy at threshold yields:**

	Land rev. + (TR-TC)	Land rev. + cess + (TR-TC)
Tomato seed	0.05%	0.08%
Sunflower seed	1.68%	2.95%
Chillies-cotton	(i) 0.15%	(i) 0.26%
	(ii) 0.15%	(ii) 0.26%

**E.35. Suggested rates of levy:**

Three rates for the supplementary levy are suggested, as a percentage of (TR-TC), not of TR: 0.5%; 1%; 5%.

These rates are not unduly burdensome, particularly keeping in mind recommendations # A.2(ii), viz. that land revenue should be deductible from the supplementary levy payable.

**E.36. Revenue increase factors:**

Indicated below, at the three suggested rates of levy, are the approximate revenue increase factors over maximum land revenue inclusive of cess currently payable (see # E.34).

	0.5%	1%	5%
Tomato	6	12	59
Sunflower	..	..	2
Chillies-cotton	(i) 2	4	19
	(ii) 2	4	19

The net income from sunflower seed propagation is so low that present-day land revenue already constitutes more than a 1% rate of levy.

**E.37. Rate structure:**

As already recommended (# D.24), a single rate is levied on all cultivators above the threshold for purposes of simplifying the tax and its information requirement. The absolute amount payable, obtained by applying the suggested rates of levy to (TR-TC) at the threshold yield, at prices prevailing at the time of survey (1995), are as follows:

**Absolute levy (Rupees per acre at 1995 prices):**

	0.5%	1%	5%	Max. land revenue presently payable (incl. cess) per acre
Tomato (per 0.75 acre)	126	252	1258	28
Sunflower (per acre)	..	..	48	28
Chillies-cotton (per acre)	(i) 12	24	121	6
	(ii) 12	24	121	6

## Appendix A

**Table A.1: Treatment of Agricultural Income under Central Income Tax: Enactments and Committee Recommendations**

Year/s	Committee/Act	Features/ Suggestions
1860-	Income Tax Act	Included agricultural income
1865-	No income taxation	
1867-	Licence Tax	Only on income from trades & professions
1868-	Certificate Tax	Exempted agricultural income
1869-	General Income Tax (Annual Tax)	Included agricultural income
1873-	Annual tax withdrawn	
1877-	Local Direct Taxes	Exempted agricultural income
1886-	Income Tax Act*	Exempted agricultural income
1918-	Income Tax Act*	Exempted agricultural income
1922-	Income Tax Act	Exempted agricultural income
1925	Indian Taxation Enquiry (Todhunter) Committee	Emphasised the need to tax agricultural income.
1935-	Income Tax Act	Agricultural income exempted under the Act, but declared taxable by Provincial Governments
1961-	Income Tax Act	Exempted agricultural income
1971	Direct Taxes Enquiry (Wanchoo) Committee	Recommended Central taxation of agricultural income
1972	The Committee on Taxation of Agricultural Wealth and Income (Raj) Committee	Proposed:- # Agricultural Holdings Tax (AHT): a State-level replacement for land revenue; no Central taxation of agricultural income # Integration under Central Income Tax of agricultural with non-agricultural income only for determining slab rates applicable to non-agricultural income.
1973-	Finance Act	Implemented the second Raj Committee recommendation
1978	Direct Tax Law Committee (Choksi) Committee	Recommended Central taxation of agricultural income
1985	Long Term Fiscal Policy	Recommended continuation of Central exemption of agricultural income
1991	The Tax Reform (Chelliah) Committee	Recommended Central taxation of non-plantation agricultural income in excess of Rs. 25,000 for those with taxable non-agricultural income.

**Source:** Tabulated from Balasubramaniam, 1996:38-44; supplemented by Joshi et.al., 1968.  
**Note: \*** These Central enactments were administered by Provincial (State) Governments.

**Table A.2: Treatment of Agricultural Property under Central Wealth Tax Enactments**

Year/s	Committee/Act	Recommendations/Features
1957-	Wealth Tax Act	Exempted agricultural property
1970-		Taxable: All agricultural land and buildings subject to: 1. Threshold for value of land and buildings. 2. Exemption for value of growing crops.
1981-		Taxable: Plantation lands including plants/trees and buildings on such plantations. Exempted: All other agricultural property .
1983-		Exempted: All agricultural property.

Source: Tabulated from Balasubramaniam, 1996:45-48.

- Notes: 1. This table presents only those Wealth Tax enactments which altered the pre-existing treatment of agricultural property. Exemption for agricultural property has continued through enactments after 1983.
2. During the period 1970-83, when agricultural property was taxable, the wealth tax was not payable by companies. Since 1983, wealth tax is payable by companies, but agricultural property is exempted from the wealth tax.

**Table A.3: Treatment of Agricultural Property under Central Capital Gains Enactments**

Year/s	Committee/Act	Recommendations/Features
1961	Income Tax Act	# To be charged on profit or gain arising from the transfer of a capital asset effected during the financial year; # Capital asset means property of every kind held by a taxpayer including property held for his business or profession; it excludes, <i>inter alia</i> , agricultural land in India.
1970-		Agricultural lands falling within 8 km. of municipal boundaries or a cantonment board of an area having population of 10000 or more are treated as "capital assets", liable to capital gains. All other agricultural land is not liable.

Source: Tabulated from Balasubramaniam, 1996:44-45.

**Table A.4: Basis of Levy of Land Revenue in the States**

State	Basis
Andhra Pradesh	<p>Andhra Region (ryotwari pre-Independence): Net value per acre at 'commutation rates', i.e., the average price of the grain in 20 immediately preceding non-famine years after making allowances for transport charges and merchants' profit, and estimated expenses of cultivation.</p> <p>Telengana Region (non-ryotwari pre-Independence): 'Empirical basis' i.e., based on soil and agro-climatic conditions.</p>
Assam	<p>Varies between areas under ryotwari and non-ryotwari pre-Independence settlements;</p> <p>Net income in principle</p>
Bihar	<p>After elimination of intermediaries, crop-based in principle but in practice essentially ad hoc.</p>
Gujarat	<p>Ryotwari pre-Independence: Gross yield of principal crops.</p> <p>Non-ryotwari pre-Independence: Ad hoc.</p>
Himachal Pradesh	<p>'Net assets', defined as the average surplus after deduction of expenses of cultivation.</p>
Jammu & Kashmir	<p>Not uniform;</p> <p>Most usually yield by soil class.</p>
Kerala	<p>Basic tax at flat rate per hectare without reference to actual or potential income except below a gross income threshold, where tax is levied at 1/5 gross income.</p> <p>Land cess at 1/16 of market value of land.</p> <p>Plantation tax at flat rate per hectare of plantation land.</p>
Madhya Pradesh	<p>Soil-based basic levy.</p> <p>Flat rate crop-specific cesses on acreage sown to commercial crops.</p>
Maharashtra	<p>Gross produce of principal crops.</p> <p>Flat rate crop-specific cess on acreage sown to commercial crops.</p>
Mysore	<p>Gross produce of principal crops.</p>



State	Basis
Orissa	<p>Basic land revenue abolished but cesses levied at some % of notional land revenue.</p> <p>Basis of notional land revenue highly variable between areas under different pre-Independence settlement regimes, and even within ryotwari areas.</p>
Punjab	"Net assets" defined as the average surplus after deduction of expenses of cultivation, as in Himachal Pradesh.
Rajasthan	"Rental value" based on gross produce at the average price prevailing for the last 20 years, and expenses of cultivation.
Tamil Nadu	"Commuted value" of each staple crop, as calculated in the Andhra region of AP.
Uttar Pradesh	After elimination of intermediaries, continuation of earlier soil-based rates.
West Bengal	After elimination of intermediaries, continuation of earlier essentially ad hoc rates.

**Source:** Tabulated from Government of India, Report of the Committee on Taxation of Agricultural Wealth and Income, 1971 (Raj Committee).

- Notes:**
1. No land revenue is levied in Haryana; Manipur; much of Meghalaya; Nagaland.
  2. The terms used are reported within quotation marks, with the definition of the term as it is used in the context in question rather than as it is generally used.
  3. The table gives no information on:
    - i. Whether there is an acreage exemption threshold below which the land revenue does not apply;
    - ii. The number of dimensions along which stratification is done;
    - iii. General cesses or surcharges.

## Appendix B

### Area, Production, Yields and Seasons of Important Crops in Karnataka

Karnataka is the eighth largest state in the country with 19.05 million hectares of geographical area, of which 56 per cent (10.71 million ha.) was under cultivation in 1989-90. About two-thirds of the population depend on agriculture for their livelihood and agriculture contributes more than one-third to the state GDP.

Area, production and yields per hectare of important crops between 1955-1958 and 1987-90 are presented in Table B.1 below.

The cropping pattern of the state is dominated by foodgrains (cereals and pulses), but while the absolute area under these has remained unchanged, their relative share of gross cropped area has declined somewhat on account of the doubling of area under oilseeds, and a trebling of area under sugarcane (in areas newly brought under canai irrigation).

Little yield improvement seems to have occurred in the major cereals paddy, jowar and ragi. Substantial yield improvements without cereals were recorded only in the case of what for Karnataka are minor crops: wheat, maize and pearl millet. The largest productivity increase was recorded in cotton, the yield of which more than quintupled.

Table B.2 breaks down the yield figures by decade. The 1980s are stylised as a period of yield stagnation in Karnataka, as compared to the sixties and seventies, but this was not uniformly true. Cotton productivity for example seems to have increased only in the eighties. Further, the figures for the period 1980-81 to 1993-94 suggest that yield stagnation in cereals may have been reversed in the early nineties.

The essential point brought out very clearly in the table is the diversity of experience in terms of crop yields over time. Some crops like oilseeds exhibit yield stagnation right through. Others have had periods of yield improvements, where these are not synchronised across crops. It remains only to add that the State-wise figures conceal sharp differences between districts within the States in terms of yields even for the same crop, in order to underline the need for a crop and location-specific approach to agricultural taxation, and

for the local retention of revenues so raised for yield enhancement through better land and water management.

**Table B.1: Area, Yield and Production of Principal Crops in Karnataka Between 1955-58 and 1987-90**

Crops	1987-90			1955-1986 to 1987-90		
	Area (in 000 ha.)	Yield (tonnes/ha)	Production (000 tonnes)	Area	Yield	Production
Total cereals	5800.81	1.06	6131.68	(0.16%)	(87.74%)	(88.14%)
Total pulses	1682.36	0.33	558.64	(27.63%)	(25.76%)	(60.75%)
Total oil seeds	2430.60	0.58	1416.83	(92.83%)	(6.00%)	(104.46%)
Cotton *	609.13	1.29	786.31	(-42.81%)	(517.70%)	(82.28%)
Sugarcane	235.47	81.60	19215.00	(333.09%)	(30.00%)	(463.01%)
Constituent items in total cereals:						
Paddy	1156.24	1.95	2257.84	(27.72%)	(54.14%)	(96.80%)
Jowar	2303.63	0.69	1582.76	(-13.24%)	(85.67%)	(60.94%)
Ragi	1144.60	1.04	1187.96	(26.94%)	(17.95%)	(49.64%)
Maize	236.89	2.67	632.09	(2081.00%)	(283.33%)	(8261.00%)
P. Millet	482.77	0.51	247.26	(-9.36%)	(133.79%)	(111.78%)
Wheat	250.68	0.51	247.26	(-17.52%)	(133.79%)	(111.78%)
Other Millets	226.01	0.42	95.31	(-53.08%)	(42.09%)	(-33.38%)

**Source:** Bhende and Hanumappa, 1995.

**Notes:** Figures in brackets indicate percentage increase/decrease between the trienniums 1955-58 and 1987-90.

\* Cotton production in '000' Bales of 170 kgs.

**Table B.2: Decadal Annual Growth Rates of Productivity of Principal Crops in Karnataka**

Crops	1955-56 to 69-70	1970-71 to 79-80	1980-81 to 89-90	1980-81 to 93-94
Total cereals	1.92* (2.94)	3.05* (2.72)	0.24 (0.29)	2.31* (3.21)
Total pulses	1.71* (4.77)	2.29* (1.51)	-0.90 (-0.77)	0.34 (0.46)
Total oilseeds	0.09 (0.11)	-0.57 (-0.27)	0.49 (0.42)	0.35 (0.57)
Cotton	-2.64* (-2.83)	-0.28 (-0.16)	9.73* (7.95)	7.37* (7.83)
Sugarcane	2.74* (7.47)	-2.15* (-3.15)	0.36 (0.72)	0.64* (2.02)
<b>Major cereals:</b>				
Paddy	1.19* (1.51)	1.48 (1.48)	-0.20 (-0.42)	1.21* (2.95)
Jowar	4.10* (7.46)	4.09* (7.46)	-1.47 (-1.32)	0.43 (0.49)
Ragi	-4.02* (-2.92)	5.03* (2.50)	-0.26 (-0.18)	1.29 (1.27)

**Source:** Bhende and Hanummappa, 1995.

**Note:** T-values are in parentheses; asterisks mark growth rates significantly different from zero at 10% level.

There are three crop seasons, kharif, rabi and summer, defined by time of sowing/planting. Kharif crops are generally sown or planted on the onset of the monsoon. The season extends from late May to September. Crops sown during October through December or even January are classified as rabi crops, and are generally grown under irrigated conditions. However a rabi crop can be raised without irrigation on some soils with residual moisture. Summer season crops are planted at the end of January through April and necessarily require irrigation.

Although tomato and sunflower can be grown in any of the three seasons, seed propagation is always done in the rabi season because of the need for dry conditions during the ripening period. Intercropped cotton-chillies is a rainfed kharif season crop.

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## **ANNEX TABLES**

## Tomato Seed Propagation

**Table T-1 : Land Preparation**

LABOUR																	
S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp./ Unit	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp./ Ac.	Exp/ P.D.
1	3.0	3.0	1.0	25	75.0	25.0	0.0	0.0		0.0	0.0	3.0	1.0	75.0	25.0	33.3	25
2	1.0	1.0	1.0	25	25.0	25.0	0.0	0.0		0.0	0.0	1.0	1.0	25.0	25.0	33.3	25
3	1.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4	2.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5	1.0	2.0	2.0	20	40.0	40.0	0.0	0.0		0.0	0.0	2.0	2.0	40.0	40.0	53.3	20
6	2.0	2.0	1.0	20	40.0	20.0	0.0	0.0		0.0	0.0	2.0	1.0	40.0	20.0	26.7	20
7	0.5	0.0	0.0		0.0	0.0	2.0	4.0	20	40.0	80.0	2.0	4.0	40.0	80.0	106.7	20
8	1.0	0.0	0.0		0.0	0.0	4.0	4.0	20	80.0	80.0	4.0	4.0	80.0	80.0	106.7	20
9	1.0	0.0	0.0		0.0	0.0	4.0	4.0	20	80.0	80.0	4.0	4.0	80.0	80.0	106.7	20
10	1.0	0.0	0.0		0.0	0.0	4.0	4.0	20	80.0	80.0	4.0	4.0	80.0	80.0	106.7	20
11	1.0	1.0	1.0	20	20.0	20.0	0.0	0.0		0.0	0.0	1.0	1.0	20.0	20.0	26.7	20
12	1.0	1.0	1.0	20	20.0	20.0	0.0	0.0		0.0	0.0	1.0	1.0	20.0	20.0	26.7	20
13	1.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
14	1.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
15	1.0	1.0	1.0	25	25.0	25.0	0.0	0.0		0.0	0.0	1.0	1.0	25.0	25.0	33.3	25
16	3.0	3.0	1.0	25	75.0	25.0	0.0	0.0		0.0	0.0	3.0	1.0	75.0	25.0	33.3	25
AVG.(Unwtd.)			0.6	22.5		12.5		1.0	20.00		20.0		1.6		32.5	43.3	21.7
S.D.													1.5		29.6	39.4	2.4

**Table T-1 (Contd.) : Land Preparation**

BULLOCK & TRACTOR														
S. No.	Units	B.D.	B.D/ Unit	Rate	Exp.	Exp./ Unit	T-Days	T-Days/ Unit	Rate	Exp.	Exp./ Unit	Total exp.	Exp./ Unit	Exp./ Ac.
1	3.0	3.00	1.00	75	225.0	75.0	0.00	0.00		0.0	0.0	225.0	75.0	100.0
2	1.0	1.00	1.00	75	75.0	75.0	0.00	0.00		0.0	0.0	75.0	75.0	100.0
3	1.0	0.50	0.50	75	37.5	37.5	0.50	0.50	1000	500.0	500.0	537.5	537.5	716.7
4	2.0	5.00	2.50	80	400.0	200.0	0.00	0.00		0.0	0.0	400.0	200.0	266.7
5	1.0	1.00	1.00	75	75.0	75.0	0.00	0.00		0.0	0.0	75.0	75.0	100.0
6	2.0	2.00	1.00	75	150.0	75.0	0.00	0.00		0.0	0.0	150.0	75.0	100.0
7	0.5	1.25	2.50	75	93.8	187.5	0.00	0.00		0.0	0.0	93.8	187.5	250.0
8	1.0	3.25	3.25	75	243.8	243.8	0.00	0.00		0.0	0.0	243.8	243.8	325.0
9	1.0	2.50	2.50	75	187.5	187.5	0.00	0.00		0.0	0.0	187.5	187.5	250.0
10	1.0	2.50	2.50	75	187.5	187.5	0.00	0.00		0.0	0.0	187.5	187.5	250.0
11	1.0	1.00	1.00	75	75.0	75.0	0.25	0.25	1000	250.0	250.0	325.0	325.0	433.3
12	1.0	1.00	1.00	75	75.0	75.0	0.25	0.25	1000	250.0	250.0	325.0	325.0	433.3
13	1.0	3.00	3.00	75	225.0	225.0	0.00	0.00		0.0	0.0	225.0	225.0	300.0
14	1.0	2.50	2.50	75	187.5	187.5	0.00	0.00		0.0	0.0	187.5	187.5	250.0
15	1.0	0.00	0.00		0.0	0.0	0.50	0.50	1100	550.0	550.0	550.0	550.0	733.3
16	3.0	0.00	0.00		0.0	0.0	1.50	0.50	1000	1500.0	500.0	1500.0	500.0	666.7
AVG.(Unwtd.)			1.58			119.1		0.13			128.1		247.3	329.7
S.D.			1.04			78.5		0.20			203.8		155.6	207.5

## Tomato Seed Propagation

### Table T-2: Manuring

LABOUR																		MANURE		
S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp/ Unit	P.D.	P.D./ Unit	Exp.	Exp/ Unit	Exp/ Ac.	Exp/ P.D.	EXP.	EXP/ Unit	Exp./ Acre
1	3.0	4.0	1.3	25	100.0	33.3	0.0	0.0		0.0	0.0	4.0	1.3	100.0	33.3	44.4	25.0	900.0	300.0	400.0
2	1.0	2.0	2.0	25	50.0	50.0	0.0	0.0		0.0	0.0	2.0	2.0	50.0	50.0	66.7	25.0	300.0	300.0	400.0
3	1.0	1.0	1.0	20	20.0	20.0	0.0	0.0		0.0	0.0	1.0	1.0	20.0	20.0	26.7	20.0	400.0	400.0	533.3
4	2.0	6.0	3.0	25	150.0	75.0	0.0	0.0		0.0	0.0	6.0	3.0	150.0	75.0	100.0	25.0	600.0	300.0	400.0
5	1.0	1.0	1.0	20	20.0	20.0	0.0	0.0		0.0	0.0	1.0	1.0	20.0	20.0	26.7	20.0	600.0	600.0	800.0
6	2.0	3.0	1.5	20	60.0	30.0	0.0	0.0		0.0	0.0	3.0	1.5	60.0	30.0	40.0	20.0	1800.0	900.0	1200.0
7	0.5	2.0	4.0	25	50.0	100.0	0.0	0.0		0.0	0.0	2.0	4.0	50.0	100.0	133.3	25.0	300.0	600.0	800.0
8	1.0	2.0	2.0	25	50.0	50.0	0.0	0.0		0.0	0.0	2.0	2.0	50.0	50.0	66.7	25.0	700.0	700.0	933.3
9	1.0	3.0	3.0	25	75.0	75.0	0.0	0.0		0.0	0.0	3.0	3.0	75.0	75.0	100.0	25.0	700.0	700.0	933.3
10	1.0	3.0	3.0	25	75.0	75.0	0.0	0.0		0.0	0.0	3.0	3.0	75.0	75.0	100.0	25.0	700.0	700.0	933.3
11	1.0	0.0	0.0		0.0	0.0	3.0	3.0	20	60.0	60.0	3.0	3.0	60.0	60.0	80.0	20.0	600.0	600.0	800.0
12	1.0	5.0	5.0	20	100.0	100.0	0.0	0.0		0.0	0.0	5.0	5.0	100.0	100.0	133.3	20.0	600.0	600.0	800.0
13	1.0	3.0	3.0	20	60.0	60.0	0.0	0.0		0.0	0.0	3.0	3.0	60.0	60.0	80.0	20.0	600.0	600.0	800.0
14	1.0	2.0	2.0	25	50.0	50.0	0.0	0.0		0.0	0.0	2.0	2.0	50.0	50.0	66.7	25.0	480.0	480.0	640.0
15	1.0	4.0	4.0	25	100.0	100.0	0.0	0.0		0.0	0.0	4.0	4.0	100.0	100.0	133.3	25.0	480.0	480.0	640.0
16	3.0	15.0	5.0	25	375.0	125.0	0.0	0.0		0.0	0.0	15.0	5.0	375.0	125.0	166.7	25.0	1200.0	400.0	533.3
AVG.(Unwtd.)			2.6	23.33		60.2		0.2	20.00				2.7		64.0	85.3	23.1		541.3	721.7
S.D.													1.2		30.2	40.2	2.4		166.5	222.0

## Tomato Seed Propagation

### Table T-3 : Seed Bed Preparation & Transplanting

LABOUR																		Cost of Seeds			
S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp./ Unit	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp/ Ac.	Exp/ P.D.	Seed CO.	Total Cost	Cost/ Unit	Cost/ Ac.
1	3.0	6.0	2.0	25	150.0	50.0	36.0	12.0	15.00	540.0	180.0	42.0	14.0	690.0	230.0	306.7	16.4	IAH	900.0	300.0	400.0
2	1.0	2.0	2.0	25	50.0	50.0	12.0	12.0	15.00	180.0	180.0	14.0	14.0	230.0	230.0	306.7	16.4	Nath	250.0	250.0	333.3
3	1.0	2.0	2.0	20	40.0	40.0	12.0	12.0	15.00	180.0	180.0	14.0	14.0	220.0	220.0	293.3	15.7	IAH	300.0	300.0	400.0
4	2.0	3.0	1.5	25	75.0	37.5	21.5	10.8	11.84	254.6	127.3	24.5	12.3	329.6	164.8	219.7	13.5	IAH	600.0	300.0	400.0
5	1.0	2.0	2.0	20	40.0	40.0	12.0	12.0	15.00	180.0	180.0	14.0	14.0	220.0	220.0	293.3	15.7	IAH	300.0	300.0	400.0
6	2.0	4.0	2.0	20	80.0	40.0	24.0	12.0	20.00	480.0	240.0	28.0	14.0	560.0	280.0	373.3	20.0	IAH	600.0	300.0	400.0
7	0.5	1.0	2.0	25	25.0	50.0	7.5	15.0	20.00	150.0	300.0	8.5	17.0	175.0	350.0	466.7	20.6	IAH	150.0	300.0	400.0
8	1.0	8.0	8.0	25	200.0	200.0	5.0	5.0	20.00	100.0	100.0	13.0	13.0	300.0	300.0	400.0	23.1	Proag	300.0	300.0	400.0
9	1.0	2.0	2.0	25	50.0	50.0	11.8	11.8	20.00	235.0	235.0	13.8	13.8	285.0	285.0	380.0	20.7	IAH	300.0	300.0	400.0
10	1.0	4.0	4.0	25	100.0	100.0	11.8	11.8	20.00	235.0	235.0	15.8	15.8	335.0	335.0	446.7	21.3	Proag	300.0	300.0	400.0
11	1.0	2.0	2.0	20	40.0	40.0	12.0	12.0	15.00	180.0	180.0	14.0	14.0	220.0	220.0	293.3	15.7	IAH	300.0	300.0	400.0
12	1.0	2.0	2.0	15	30.0	30.0	12.0	12.0	15.00	180.0	180.0	14.0	14.0	210.0	210.0	280.0	15.0	IAH	300.0	300.0	400.0
13	1.0	2.0	2.0	20	40.0	40.0	12.0	12.0	15.00	180.0	180.0	14.0	14.0	220.0	220.0	293.3	15.7	IAH	300.0	300.0	400.0
14	1.0	2.0	2.0	25	50.0	50.0	12.0	12.0	15.00	180.0	180.0	14.0	14.0	230.0	230.0	306.7	16.4	IAH	300.0	300.0	400.0
15	1.0	2.0	2.0	25	50.0	50.0	12.0	12.0	15.00	180.0	180.0	14.0	14.0	230.0	230.0	306.7	16.4	Begen	300.0	300.0	400.0
16	3.0	6.0	2.0	25	150.0	50.0	40.0	13.3	15.00	600.0	200.0	46.0	15.3	750.0	250.0	333.3	16.3	IAH	900.0	300.0	400.0
AVG.(Unwtd.)			2.5	22.81		57.3		11.7	16.37		191.1		14.2		248.4	331.2	17.4			296.9	395.8
S.D													1.0		47.3	63.1	2.7			12.1	16.1

## Tomato Seed Propagation

### Table T-4 : Irrigation

LABOUR																	
S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp./ Unit	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp./ Ac.	Exp./P.D.
1	3.0	10.0	3.3	25	250.0	83.3						10.0	3.3	250.0	83.3	111.1	25.0
2	1.0	3.0	3.0	25	75.0	75.0						3.0	3.0	75.0	75.0	100.0	25.0
3	1.0	3.0	3.0	20	60.0	60.0						3.0	3.0	60.0	60.0	80.0	20.0
4	2.0	6.0	3.0	25	150.0	75.0						6.0	3.0	150.0	75.0	100.0	25.0
5	1.0	7.5	7.5	20	150.0	150.0						7.5	7.5	150.0	150.0	200.0	20.0
6	2.0	15.0	7.5	20	300.0	150.0						15.0	7.5	300.0	150.0	200.0	20.0
7	0.5	4.0	8.0	25	100.0	200.0						4.0	8.0	100.0	200.0	266.7	25.0
8	1.0	5.0	5.0	25	125.0	125.0						5.0	5.0	125.0	125.0	166.7	25.0
9	1.0	7.5	7.5	25	187.5	187.5						7.5	7.5	187.5	187.5	250.0	25.0
10	1.0	7.5	7.5	25	187.5	187.5						7.5	7.5	187.5	187.5	250.0	25.0
11	1.0	8.0	8.0	20	160.0	160.0						8.0	8.0	160.0	160.0	213.3	20.0
12	1.0	6.0	6.0	15	90.0	90.0						6.0	6.0	90.0	90.0	120.0	15.0
13	1.0	8.0	8.0	20	160.0	160.0						8.0	8.0	160.0	160.0	213.3	20.0
14	1.0	10.0	10.0	25	250.0	250.0						10.0	10.0	250.0	250.0	333.3	25.0
15	1.0	10.0	10.0	25	250.0	250.0						10.0	10.0	250.0	250.0	333.3	25.0
16	3.0	40.0	13.3	25	1000.0	333.3						40.0	13.3	1000.0	333.3	444.4	25.0
AVG.(Unwtd.)			6.9	22.81		158.5							6.9		158.5	211.4	22.8
S.D.													2.8		73.3	97.7	3.0



## Tomato Seed Propagation

### Table T-5 : Weeding

LABOUR																	
S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp./ Unit	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp./ Ac.	Exp/ P.D.
1	3.0	1.0	0.3	25	25.0	8.3	10.0	3.3	15	150.0	50.0	11.0	3.7	175.0	58.3	77.8	15.9
2	1.0	0.5	0.5	25	12.5	12.5	4.0	4.0	15	60.0	60.0	4.5	4.5	72.5	72.5	96.7	16.1
3	1.0	0.0	0.0		0.0	0.0	32.0	32.0	15	480.0	480.0	32.0	32.0	480.0	480.0	640.0	15.0
4	2.0	0.0	0.0		0.0	0.0	40.0	20.0	15	600.0	300.0	40.0	20.0	600.0	300.0	400.0	15.0
5	1.0	0.0	0.0		0.0	0.0	30.0	30.0	15	450.0	450.0	30.0	30.0	450.0	450.0	600.0	15.0
6	2.0	1.0	0.5	20	20.0	10.0	24.0	12.0	15	360.0	180.0	25.0	12.5	380.0	190.0	253.3	15.2
7	0.5	0.0	0.0		0.0	0.0	5.0	10.0	20	100.0	200.0	5.0	10.0	100.0	200.0	266.7	20.0
8	1.0	0.0	0.0		0.0	0.0	4.0	4.0	20	80.0	80.0	4.0	4.0	80.0	80.0	106.7	20.0
9	1.0	0.0	0.0		0.0	0.0	4.0	4.0	20	80.0	80.0	4.0	4.0	80.0	80.0	106.7	20.0
10	1.0	0.0	0.0		0.0	0.0	4.0	4.0	20	80.0	80.0	4.0	4.0	80.0	80.0	106.7	20.0
11	1.0	0.0	0.0		0.0	0.0	10.0	10.0	15	150.0	150.0	10.0	10.0	150.0	150.0	200.0	15.0
12	1.0	0.0	0.0		0.0	0.0	8.0	8.0	15	120.0	120.0	8.0	8.0	120.0	120.0	160.0	15.0
13	1.0	0.5	0.5	20	10.0	10.0	10.0	10.0	15	150.0	150.0	10.5	10.5	160.0	160.0	213.3	15.2
14	1.0	0.0	0.0		0.0	0.0	24.0	24.0	15	360.0	360.0	24.0	24.0	360.0	360.0	480.0	15.0
15	1.0	0.0	0.0		0.0	0.0	12.0	12.0	15	180.0	180.0	12.0	12.0	180.0	180.0	240.0	15.0
16	3.0	0.0	0.0		0.0	0.0	20.0	6.7	15	300.0	100.0	20.0	6.7	300.0	100.0	133.3	15.0
AVG.(Unwtd.)			0.1	22.5		2.6		12.1	16.25		188.8		12.2		191.3	255.1	16.4
S.D.													9.0		131.3	175.1	2.1

**Table T-5 (Contd.) : Weeding**

<b>BULLOCK &amp; TRACTOR</b>														
S. No.	Units	B.D.	B.D/ Unit	Rate	Exp.	Exp./ Unit	T-Days	T-Days/ Unit	Rate	Exp.	Exp./ Unit	TOT EXP	EXP/U NIT	EXP/Ac.
1	3.0	1.00	0.33	75	75.0	25.0						75.0	25.0	33.3
2	1.0	0.50	0.50	75	37.5	37.5						37.5	37.5	50.0
3	1.0	0.00	0.00		0.0	0.0						0.0	0.0	0.0
4	2.0	4.00	2.00	80	320.0	160.0						320.0	160.0	213.3
5	1.0	0.50	0.50	75	37.5	37.5						37.5	37.5	50.0
6	2.0	1.00	0.50	75	75.0	37.5						75.0	37.5	50.0
7	0.5	0.50	1.00	75	37.5	75.0						37.5	75.0	100.0
8	1.0	2.00	2.00	75	150.0	150.0						150.0	150.0	200.0
9	1.0	1.00	1.00	75	75.0	75.0						75.0	75.0	100.0
10	1.0	1.00	1.00	75	75.0	75.0						75.0	75.0	100.0
11	1.0	1.00	1.00	75	75.0	75.0						75.0	75.0	100.0
12	1.0	0.50	0.50	75	37.5	37.5						37.5	37.5	50.0
13	1.0	0.50	0.50	75	37.5	37.5						37.5	37.5	50.0
14	1.0	1.00	1.00	75	75.0	75.0						75.0	75.0	100.0
15	1.0	0.00	0.00		0.0	0.0						0.0	0.0	0.0
16	3.0	2.00	0.67	75	150.0	50.0						150.0	50.0	66.7
<b>AVG. (Unwtd.)</b>			0.78			59.2							59.2	79.0
<b>S.D.</b>			0.56			43.5							43.5	58.0

## Tomato Seed Propagation

### Table T-6 : Application of Fertilizers

LABOUR																		FERTILIZER		
S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp./ Unit	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp./ Ac.	Exp./ P.D.	Exp.	Exp./ Unit	Exp./ Acre
1	3.0	0.0	0.0		0.0	0.0	5.0	1.7	15	75.0	25.0	5.0	1.7	75.0	25.0	33.3	15.0	2370.0	790.0	1053.3
2	1.0	0.0	0.0		0.0	0.0	2.0	2.0	15	30.0	30.0	2.0	2.0	30.0	30.0	40.0	15.0	1230.0	1230.0	1640.0
3	1.0	0.5	0.5	20	10.0	10.0	0.0	0.0		0.0	0.0	0.5	0.5	10.0	10.0	13.3	20.0	710.0	710.0	946.7
4	2.0	6.0	3.0	25	150.0	75.0	0.0	0.0		0.0	0.0	6.0	3.0	150.0	75.0	100.0	25.0	2720.0	1360.0	1813.3
5	1.0	1.0	1.0	20	20.0	20.0	0.0	0.0		0.0	0.0	1.0	1.0	20.0	20.0	26.7	20.0	1635.0	1635.0	2180.0
6	2.0	2.0	1.0	20	40.0	20.0	0.0	0.0		0.0	0.0	2.0	1.0	40.0	20.0	26.7	20.0	2725.0	1362.5	1816.7
7	0.5	3.0	6.0	25	75.0	150.0	0.0	0.0		0.0	0.0	3.0	6.0	75.0	150.0	200.0	25.0	765.0	1530.0	2040.0
8	1.0	0.0	0.0		0.0	0.0	6.0	6.0	20	120.0	120.0	6.0	6.0	120.0	120.0	160.0	20.0	1500.0	1500.0	2000.0
9	1.0	2.0	2.0	25	50.0	50.0	0.0	0.0		0.0	0.0	2.0	2.0	50.0	50.0	66.7	25.0	1200.0	1200.0	1600.0
10	1.0	3.0	3.0	25	75.0	75.0	0.0	0.0		0.0	0.0	3.0	3.0	75.0	75.0	100.0	25.0	1500.0	1500.0	2000.0
11	1.0	6.0	6.0	20	120.0	120.0	0.0	0.0		0.0	0.0	6.0	6.0	120.0	120.0	160.0	20.0	1805.0	1805.0	2406.7
12	1.0	4.0	4.0	20	80.0	80.0	0.0	0.0		0.0	0.0	4.0	4.0	80.0	80.0	106.7	20.0	1160.0	1160.0	1546.7
13	1.0	2.0	2.0	20	40.0	40.0	0.0	0.0		0.0	0.0	2.0	2.0	40.0	40.0	53.3	20.0	1155.0	1155.0	1540.0
14	1.0	4.0	4.0	25	100.0	100.0	0.0	0.0		0.0	0.0	4.0	4.0	100.0	100.0	133.3	25.0	1890.0	1890.0	2520.0
15	1.0	4.0	4.0	25	100.0	100.0	0.0	0.0		0.0	0.0	4.0	4.0	100.0	100.0	133.3	25.0	2000.0	2000.0	2666.7
16	3.0	12.0	4.0	25	300.0	100.0	0.0	0.0		0.0	0.0	12.0	4.0	300.0	100.0	133.3	25.0	5840.0	1946.7	2595.6
AVG.(Unwtd.)			2.5	22.69		58.8		0.6	16.67		10.9		3.1		69.7	92.9	21.6		1423.4	1897.8
S.D.													1.8		41.7	55.6	3.4		369.5	492.6

## Tomato Seed Propagation

### Table T-7 : Application of Pesticides

LABOUR																		PESTICIDES		
S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp./ Unit	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp./ Ac.	Exp./ P.D.	Exp.	Exp./ Unit	Exp./ Acre
1	3.0	12.0	4.0	25.00	300.0	100.0						12.0	4.0	300.0	100.0	133.3	25.0	4845.0	1615.0	2153.3
2	1.0	4.0	4.0	31.25	125.0	125.0						4.0	4.0	125.0	125.0	166.7	31.3	2423.0	2423.0	3230.7
3	1.0	10.0	10.0	20.00	200.0	200.0						10.0	10.0	200.0	200.0	266.7	20.0	3000.0	3000.0	4000.0
4	2.0	8.0	4.0	25.00	200.0	100.0						8.0	4.0	200.0	100.0	133.3	25.0	4000.0	2000.0	2666.7
5	1.0	8.0	8.0	20.00	160.0	160.0						8.0	8.0	160.0	160.0	213.3	20.0	2500.0	2500.0	3333.3
6	2.0	10.0	5.0	20.00	200.0	100.0						10.0	5.0	200.0	100.0	133.3	20.0	6000.0	3000.0	4000.0
7	0.5	2.0	4.0	25.00	50.0	100.0						2.0	4.0	50.0	100.0	133.3	25.0	900.0	1800.0	2400.0
8	1.0	5.0	5.0	25.00	125.0	125.0						5.0	5.0	125.0	125.0	166.7	25.0	1500.0	1500.0	2000.0
9	1.0	4.0	4.0	25.00	100.0	100.0						4.0	4.0	100.0	100.0	133.3	25.0	2000.0	2000.0	2666.7
10	1.0	3.0	3.0	25.00	75.0	75.0						3.0	3.0	75.0	75.0	100.0	25.0	1500.0	1500.0	2000.0
11	1.0	12.0	12.0	20.00	240.0	240.0						12.0	12.0	240.0	240.0	320.0	20.0	2400.0	2400.0	3200.0
12	1.0	10.0	10.0	20.00	200.0	200.0						10.0	10.0	200.0	200.0	266.7	20.0	2000.0	2000.0	2666.7
13	1.0	8.0	8.0	20.00	160.0	160.0						8.0	8.0	160.0	160.0	213.3	20.0	2500.0	2500.0	3333.3
14	1.0	8.0	8.0	25.00	200.0	200.0						8.0	8.0	200.0	200.0	266.7	25.0	3500.0	3500.0	4666.7
15	1.0	8.0	8.0	25.00	200.0	200.0						8.0	8.0	200.0	200.0	266.7	25.0	1600.0	1600.0	2133.3
16	3.0	15.0	5.0	25.00	375.0	125.0						15.0	5.0	375.0	125.0	166.7	25.0	7500.0	2500.0	3333.3
AVG.(Unwtd.)			6.4	23.52		144.4							6.4		144.4	192.5	23.5		2239.9	2986.5
S.D.													2.7		48.6	64.8	3.1		573.7	765.0

## Tomato Seed Propagation

### Table T-8: Staking, Threading & Tying

LABOUR																	
S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp./ Unit	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp./ Acre	Exp./ P.D.
1	3.0	81.6	27.2	25	2040.0	680.0	0.0	0.0		0.0	0.0	81.6	27.2	2040.0	680.0	906.7	25.0
2	1.0	27.2	27.2	25	680.0	680.0	0.0	0.0		0.0	0.0	27.2	27.2	680.0	680.0	906.7	25.0
3	1.0	21.2	21.2	25	530.0	530.0	0.0	0.0		0.0	0.0	21.2	21.2	530.0	530.0	706.7	25.0
4	2.0	35.0	17.5	25	875.0	437.5	5.0	2.5	15	75.0	37.5	40.0	20.0	950.0	475.0	633.3	23.8
5	1.0	24.7	24.7	25	617.5	617.5	0.0	0.0		0.0	0.0	24.7	24.7	617.5	617.5	823.3	25.0
6	2.0	32.0	16.0	25	800.0	400.0	60.0	30.0	15	900.0	450.0	92.0	46.0	1700.0	850.0	1133.3	18.5
7	0.5	5.0	10.0	25	125.0	250.0	7.0	14.0	20	140.0	280.0	12.0	24.0	265.0	530.0	706.7	22.1
8	1.0	28.8	28.8	25	720.0	720.0	0.0	0.0		0.0	0.0	28.8	28.8	720.0	720.0	960.0	25.0
9	1.0	22.4	22.4	25	560.0	560.0	0.0	0.0		0.0	0.0	22.4	22.4	560.0	560.0	746.7	25.0
10	1.0	25.0	25.0	25	625.0	625.0	0.0	0.0		0.0	0.0	25.0	25.0	625.0	625.0	833.3	25.0
11	1.0	27.5	27.5	25	687.5	687.5	0.0	0.0		0.0	0.0	27.5	27.5	687.5	687.5	916.7	25.0
12	1.0	29.5	29.5	25	737.5	737.5	0.0	0.0		0.0	0.0	29.5	29.5	737.5	737.5	983.3	25.0
13	1.0	29.5	29.5	25	737.5	737.5	0.0	0.0		0.0	0.0	29.5	29.5	737.5	737.5	983.3	25.0
14	1.0	25.0	25.0	25	625.0	625.0	0.0	0.0		0.0	0.0	25.0	25.0	625.0	625.0	833.3	25.0
15	1.0	29.5	29.5	25	737.5	737.5	0.0	0.0		0.0	0.0	29.5	29.5	737.5	737.5	983.3	25.0
16	3.0	82.5	27.5	25	2062.5	687.5	0.0	0.0		0.0	0.0	82.5	27.5	2062.5	687.5	916.7	25.0
AVG.(Unwtd.)			24.3	25.0		607.0		2.9	16.67		48.0		27.2		655.0	873.3	24.3
S.D.			5.4	0.0				7.8	2.36				5.6		94.2	125.6	1.7

## Tomato Seed Propagation

### Table T-9 : Cross-Pollination

LABOUR																	
S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp./ Unit	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp./ Ac.	Exp./ P.D.
1	3.0	1080.0	360.0	20	21600.0	7200.0	0.0	0.0		0.0	0.0	1080.0	360.0	21600.0	7200.0	9600.0	20.0
2	1.0	360.0	360.0	20	7200.0	7200.0	0.0	0.0		0.0	0.0	360.0	360.0	7200.0	7200.0	9600.0	20.0
3	1.0	250.0	250.0	20	5000.0	5000.0	0.0	0.0		0.0	0.0	250.0	250.0	5000.0	5000.0	6666.7	20.0
4	2.0	600.0	300.0	20	12000.0	6000.0	0.0	0.0		0.0	0.0	600.0	300.0	12000.0	6000.0	8000.0	20.0
5	1.0	150.0	150.0	20	3000.0	3000.0	90.0	90.0	20	1800.0	1800.0	240.0	240.0	4800.0	4800.0	6400.0	20.0
6	2.0	0.0	0.0		0.0	0.0	576.0	288.0	20	11520.0	5760.0	576.0	288.0	11520.0	5760.0	7680.0	20.0
7	0.5	0.0	0.0		0.0	0.0	195.0	390.0	23	4485.0	8970.0	195.0	390.0	4485.0	8970.0	11960.0	23.0
8	1.0	280.0	280.0	25	7000.0	7000.0	0.0	0.0		0.0	0.0	280.0	280.0	7000.0	7000.0	9333.3	25.0
9	1.0	0.0	0.0		0.0	0.0	300.0	300.0	20	6000.0	6000.0	300.0	300.0	6000.0	6000.0	8000.0	20.0
10	1.0	0.0	0.0		0.0	0.0	360.0	360.0	20	7200.0	7200.0	360.0	360.0	7200.0	7200.0	9600.0	20.0
11	1.0	0.0	0.0		0.0	0.0	240.0	240.0	28	6720.0	6720.0	240.0	240.0	6720.0	6720.0	8960.0	28.0
12	1.0	0.0	0.0		0.0	0.0	300.0	300.0	15	4500.0	4500.0	300.0	300.0	4500.0	4500.0	6000.0	15.0
13	1.0	0.0	0.0		0.0	0.0	250.0	250.0	20	5000.0	5000.0	250.0	250.0	5000.0	5000.0	6666.7	20.0
14	1.0	300.0	300.0	20	6000.0	6000.0	0.0	0.0		0.0	0.0	300.0	300.0	6000.0	6000.0	8000.0	20.0
15	1.0	0.0	0.0		0.0	0.0	308.0	308.0	22	6776.0	6776.0	308.0	308.0	6776.0	6776.0	9034.7	22.0
16	3.0	0.0	0.0		0.0	0.0	900.0	300.0	20	18000.0	6000.0	900.0	300.0	18000.0	6000.0	8000.0	20.0
<b>AVG.(Unwtd.)</b>			125.0	20.71		2587.5		176.6	20.80		3670.4		301.6		6257.9	8343.8	20.8
<b>S.D.</b>													44.5		1116.5	1488.7	2.7

## Tomato Seed Propagation

### Table T-10 : Harvesting & Processing

S. No.	Units	M.D.	M.D./ Unit	Wage	Exp.	Exp./ Unit	F.D.	F.D./ Unit	Wage	Exp.	Exp./ Unit	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp./ Ac.	PD/ Kg	Exp./ PD	(Kg)
1	3.0	75.0	25.0	25	1875.0	625.0	90.0	30.0	15	1350.0	450.0	165.0	55.0	3225.0	1075.0	1433.3	1.9	19.5	89.0
2	1.0	22.0	22.0	25	550.0	550.0	30.0	30.0	15	450.0	450.0	52.0	52.0	1000.0	1000.0	1333.3	3.0	19.2	17.5
3	1.0	37.0	37.0	20	740.0	740.0	28.0	28.0	15	420.0	420.0	65.0	65.0	1160.0	1160.0	1546.7	2.6	17.8	25.0
4	2.0	20.0	10.0	25	500.0	250.0	40.0	20.0	15	600.0	300.0	60.0	30.0	1100.0	550.0	733.3	2.4	18.3	25.0
5	1.0	25.0	25.0	20	500.0	500.0	1.0	1.0	18	18.0	18.0	26.0	26.0	518.0	518.0	690.7	3.5	19.9	7.5
6	2.0	30.0	15.0	20	600.0	300.0	120.0	60.0	15	1800.0	900.0	150.0	75.0	2400.0	1200.0	1600.0	1.9	16.0	79.0
7	0.5	0.0	0.0		0.0	0.0	31.0	62.0	20	620.0	1240.0	31.0	62.0	620.0	1240.0	1653.3	1.4	20.0	22.7
8	1.0	0.0	0.0		0.0	0.0	36.0	36.0	20	720.0	720.0	36.0	36.0	720.0	720.0	960.0	1.2	20.0	30.0
9	1.0	0.0	0.0		0.0	0.0	35.0	35.0	20	700.0	700.0	35.0	35.0	700.0	700.0	933.3	2.5	20.0	14.0
10	1.0	0.0	0.0		0.0	0.0	39.0	39.0	20	780.0	780.0	39.0	39.0	780.0	780.0	1040.0	1.7	20.0	23.0
11	1.0	5.0	5.0	20	100.0	100.0	30.0	30.0	15	450.0	450.0	35.0	35.0	550.0	550.0	733.3	1.0	15.7	33.6
12	1.0	0.0	0.0		0.0	0.0	60.0	60.0	15	900.0	900.0	60.0	60.0	900.0	900.0	1200.0	1.3	15.0	47.3
13	1.0	10.0	10.0	20	200.0	200.0	30.0	30.0	15	450.0	450.0	40.0	40.0	650.0	650.0	866.7	0.9	16.3	42.3
14	1.0	60.0	60.0	25	1500.0	1500.0	0.0	0.0		0.0	0.0	60.0	60.0	1500.0	1500.0	2000.0	1.5	25.0	40.1
15	1.0	0.0	0.0		0.0	0.0	40.0	40.0	15	600.0	600.0	40.0	40.0	600.0	600.0	800.0	1.3	15.0	30.0
16	3.0	0.0	0.0		0.0	0.0	144.0	48.0	15	2160.0	720.0	144.0	48.0	2160.0	720.0	960.0	1.6	15.0	92.0
AVG.(Unwtd.)			13.1	22.22		297.8		34.3	16.53		568.6		47.4		866.4	1155.3	1.9	18.3	
S.D.													13.8		287.1	382.7	0.7	2.6	

## Tomato Seed Propagation

### Table T-11 : Labour Summary

S. No.	Units	M.D.	M.D./ Unit	Exp.	Exp./ Unit	Exp./ MD	F.D.	F.D./ Unit	Exp.	Exp./ Unit	Exp./ FD	P.D.	P.D./ Unit	Exp.	Exp./ Unit	Exp./ Ac.	Exp./ P.D.
1	3.0	1272.6	424.2	26415.0	8805.0	20.8	141.0	47.0	2115.0	705.0	15.0	1413.6	471.2	28530.0	9510.0	12680.0	20.2
2	1.0	421.7	421.7	8767.5	8767.5	20.8	48.0	48.0	720.0	720.0	15.0	469.7	469.7	9487.5	9487.5	12650.0	20.2
3	1.0	324.7	324.7	6600.0	6600.0	20.3	72.0	72.0	1080.0	1080.0	15.0	396.7	396.7	7680.0	7680.0	10240.0	19.4
4	2.0	684.0	342.0	14100.0	7050.0	20.6	106.5	53.3	1529.6	764.8	14.4	790.5	395.3	15629.6	7814.8	10419.7	19.8
5	1.0	221.2	221.2	4547.5	4547.5	20.6	133.0	133.0	2448.0	2448.0	18.4	354.2	354.2	6995.5	6995.5	9327.3	19.8
6	2.0	99.0	49.5	2140.0	1070.0	21.6	804.0	402.0	15060.0	7530.0	18.7	903.0	451.5	17200.0	8600.0	11466.7	19.0
7	0.5	17.0	34.0	425.0	850.0	25.0	247.5	495.0	5535.0	11070.0	22.4	264.5	529.0	5960.0	11920.0	15893.3	22.5
8	1.0	328.8	328.8	8220.0	8220.0	25.0	55.0	55.0	1100.0	1100.0	20.0	383.8	383.8	9320.0	9320.0	12426.7	24.3
9	1.0	40.9	40.9	1022.5	1022.5	25.0	354.8	354.8	7095.0	7095.0	20.0	395.7	395.7	8117.5	8117.5	10823.3	20.5
10	1.0	45.5	45.5	1137.5	1137.5	25.0	418.8	418.8	8375.0	8375.0	20.0	464.3	464.3	9512.5	9512.5	12683.3	20.5
11	1.0	61.5	61.5	1367.5	1367.5	22.2	295.0	295.0	7560.0	7560.0	25.6	356.5	356.5	8927.5	8927.5	11903.3	25.0
12	1.0	57.5	57.5	1257.5	1257.5	21.9	380.0	380.0	5700.0	5700.0	15.0	437.5	437.5	6957.5	6957.5	9276.7	15.9
13	1.0	63.0	63.0	1407.5	1407.5	22.3	302.0	302.0	5780.0	5780.0	19.1	365.0	365.0	7187.5	7187.5	9583.3	19.7
14	1.0	411.0	411.0	8775.0	8775.0	21.4	36.0	36.0	540.0	540.0	15.0	447.0	447.0	9315.0	9315.0	12420.0	20.8
15	1.0	58.5	58.5	1462.5	1462.5	25.0	372.0	372.0	7736.0	7736.0	20.8	430.5	430.5	9198.5	9198.5	12264.7	21.4
16	3.0	173.5	57.8	4337.5	1445.8	25.0	1104.0	368.0	21060.0	7020.0	19.1	1277.5	425.8	25397.5	8465.8	11287.8	19.9
AVG.(Unwtd.)			183.9		3986.6	22.7		239.5		4701.5	18.3		423.3		8688.1	11584.1	20.6
S.D.			156.2		3283.4	1.9		162.2		3432.4	3.1		47.0		1220.2	1627.0	2.0



## Tomato Seed Propagation

### Table T-12: Mechanical Energy Summary

S. No.	Units	B.D.	B.D/ Unit	Exp.	Exp/ Unit	Exp/ BD	T-Days	T-Days/ Unit	Exp.	Exp/ Unit	Exp/ TD	Total exp.	Exp/ Unit	Exp/ Ac.
1	3.0	4.00	1.33	300.0	100.0	75.0	0	0.0	0	0	0	300.0	100.00	133.3
2	1.0	1.50	1.50	112.5	112.5	75.0	0	0.0	0	0	0	112.5	112.50	150.0
3	1.0	0.50	0.50	37.5	37.5	75.0	0.5	0.5	500	500	1000	537.5	537.50	716.7
4	2.0	9.00	4.50	720.0	360.0	80.0	0	0.0	0	0	0	720.0	360.00	480.0
5	1.0	1.50	1.50	112.5	112.5	75.0	0	0.0	0	0	0	112.5	112.50	150.0
6	2.0	3.00	1.50	225.0	112.5	75.0	0	0.0	0	0	0	225.0	112.50	150.0
7	0.5	1.75	3.50	131.3	262.5	75.0	0	0.0	0	0	0	131.3	262.50	350.0
8	1.0	5.25	5.25	393.8	393.8	75.0	0	0.0	0	0	0	393.8	393.75	525.0
9	1.0	3.50	3.50	262.5	262.5	75.0	0	0.0	0	0	0	262.5	262.50	350.0
10	1.0	3.50	3.50	262.5	262.5	75.0	0	0.0	0	0	0	262.5	262.50	350.0
11	1.0	2.00	2.00	150.0	150.0	75.0	0.25	0.25	250	250	1000	400.0	400.00	533.3
12	1.0	1.50	1.50	112.5	112.5	75.0	0.25	0.25	250	250	1000	362.5	362.50	483.3
13	1.0	3.50	3.50	262.5	262.5	75.0	0	0.0	0	0	0	262.5	262.50	350.0
14	1.0	3.50	3.50	262.5	262.5	75.0	0	0.0	0	0	0	262.5	262.50	350.0
15	1.0	0.00	0.00	0.0	0.0	0.0	0.5	0.5	550	550	1100	550.0	550.00	733.3
16	3.0	2.00	0.67	150.0	50.0	75.0	1.5	0.5	1500	500	1000	1650.0	550.00	733.3
AVG.(Unwtd.)			2.36		178.36			0.13		128.13			306.48	408.65
S.D.			1.49		113.80			0.20		203.84			149.90	199.87

## Tomato Seed Propagation

**Table T-13 : Surplus of Revenue Over Total Variable Cost**

S. No.	Unit area	VARIABLE INPUT COST PER UNIT AREA							Total var. cost per unit	Total var. cost per acre	TR/Unit	(TR-TVC)/unit	(TR-TVC)/acre	(TR-TVC)/TR (%)
		Labour	Mech. energy	Manure	Seed	Ferti-lizers	Pesti-cides	Other						
1	3.0	9510.0	100.0	300.0	300.0	790.0	1615.0	1395.0	14010.0	18680.0	56366.7	42356.7	56475.6	75.14
2	1.0	9487.5	112.5	300.0	250.0	1230.0	2423.0	1395.0	15198.0	20264.0	59500.0	44302.0	59069.3	74.46
3	1.0	7680.0	537.5	400.0	300.0	710.0	3000.0	1395.0	14022.5	18696.7	47500.0	33477.5	44636.7	70.48
4	2.0	7814.8	360.0	300.0	300.0	1360.0	2000.0	1395.0	13529.8	18039.7	23750.0	10220.2	13626.9	43.03
5	1.0	6995.5	112.5	600.0	300.0	1635.0	2500.0	1395.0	13538.0	18050.7	14250.0	712.0	949.3	5.00
6	2.0	8600.0	112.5	900.0	300.0	1362.5	3000.0	1395.0	15670.0	20893.3	75050.0	59380.0	79173.3	79.12
7	0.5	11920.0	262.5	600.0	300.0	1530.0	1800.0	1395.0	17807.5	23743.3	86260.0	68452.5	91270.0	79.36
8	1.0	9320.0	393.8	700.0	300.0	1500.0	1500.0	1395.0	15108.8	20145.0	48000.0	32891.3	43855.0	68.52
9	1.0	8117.5	262.5	700.0	300.0	1200.0	2000.0	1395.0	13975.0	18633.3	26600.0	12625.0	16833.3	47.46
10	1.0	9512.5	262.5	700.0	300.0	1500.0	1500.0	1395.0	15170.0	20226.7	36800.0	21630.0	28840.0	58.78
11	1.0	8927.5	400.0	600.0	300.0	1805.0	2400.0	1395.0	15827.5	21103.3	63916.0	48088.5	64118.0	75.24
12	1.0	6957.5	362.5	600.0	300.0	1160.0	2000.0	1395.0	12775.0	17033.3	89908.0	77133.0	102844.0	85.79
13	1.0	7187.5	262.5	600.0	300.0	1155.0	2500.0	1395.0	13400.0	17866.7	80370.0	66970.0	89293.3	83.33
14	1.0	9315.0	262.5	480.0	300.0	1890.0	3500.0	1395.0	17142.5	22856.7	76190.0	59047.5	78730.0	77.50
15	1.0	9198.5	550.0	480.0	300.0	2000.0	1600.0	1395.0	15523.5	20698.0	54000.0	38476.5	51302.0	71.25
16	3.0	8465.8	550.0	400.0	300.0	1946.7	2500.0	1395.0	15557.5	20743.3	58266.7	42709.2	56945.6	73.30
<b>AVG</b>	1.3	8688.10	306.48	541.25	296.88	1423.39	2239.88	1395.00	14890.97	19854.63	56045.46	41154.49	54872.65	66.73
<b>S.D.</b>	0.7	1220.22	149.90	166.50	-	369.47	573.72	-	1343.42	1791.23	21889.47	21421.81	28562.42	19.62
<b>C.V.</b>	0.5	0.14	0.49	0.31		0.26	0.26		0.09	0.09	0.39	0.52	0.52	0.29

**Table T-13 (Contd.)**

**Notes:** Annual expenditure on consumables was imputed as follows:

Operation	Material	Input/unit area	Cost/unit input(Rs)	Exp/uni area(Rs)
Staking	Poles	3500	0.25*	875.00
	Thread kg.	10	22.00	220.00
Harvesting & Process- ing	Buckets			
	Sieves			
	Mesh			300.00
Total				1395.00

There are two types of poles reported for the staking operation. One costs Rs. 2.50 per pole and lasts for 10 years, thus yielding the cost figure of Rs. 0.25/pole/year. The other costs between Rs. 0.45-Rs.0.80 per pole and lasts between 2-3 Years, with the upper end of this price and durability range also yielding the cost figure used. At the lower end, the cost per pole per year is marginally lower, but this option does not dominate, presumably because of the higher transactions costs of having to make a purchase every other year.

## Sunflower Seed Propagation

### Table S-1 : Land Preparation

<b>LABOUR</b>																
S. No.	Acres	M.D.	M.D./ Ac.	Wage	Exp.	Exp./ Ac.	F.D.	F.D./ Ac	Wage	Exp.	Exp./ Ac.	P.D.	P.D./ Ac	Exp.	Exp./ Ac.	Exp./ P.D.
1	5.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
2	1.0	0.0	0.0		0.0	0.0	2.0	2.0	20	40.0	40.0	2.0	2.0	40.0	40.0	20.0
3	1.0	0.0	0.0		0.0	0.0	4.0	4.0	20	80.0	80.0	4.0	4.0	80.0	80.0	20.0
4	1.0	0.0	0.0		0.0	0.0	4.0	4.0	20	80.0	80.0	4.0	4.0	80.0	80.0	20.0
5	3.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
6	1.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
7	1.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
8	1.0	1.0	1.0	25	25.0	25.0	0.0	0.0		0.0	0.0	1.0	1.0	25.0	25.0	25.0
9	5.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
10	4.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
11	3.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
12	2.0	0.0	0.0		0.0	0.0	4.0	2.0	15	60.0	30.0	4.0	2.0	60.0	30.0	7.5
13	2.0	0.0	0.0		0.0	0.0	4.0	2.0	15	60.0	30.0	4.0	2.0	60.0	30.0	7.5
<b>AVG</b>			0.1	25		1.9		1.1	18.0		20.0		1.2		21.9	16.7
<b>S.D.</b>				0					2.4				1.5		28.5	6.7

**Table S-1 (Contd): Land Preparation**

<b>BULLOCK &amp; TRACTOR</b>													
S. No.	Acres	B.D.	B.D./ Ac.	Rate	Exp.	Exp./ Ac.	Total days	Total days/Ac	Rate	Exp.	Exp./ Ac	Exp.	Exp./ Ac
1	5.0	12.00	2.40	75	900.0	180.0	0.00	0.00		0.0	0.0	900.0	180.0
2	1.0	3.00	3.00	75	225.0	225.0	0.00	0.00		0.0	0.0	225.0	225.0
3	1.0	2.00	2.00	75	150.0	150.0	0.00	0.00		0.0	0.0	150.0	150.0
4	1.0	3.00	3.00	75	225.0	225.0	0.00	0.00		0.0	0.0	225.0	225.0
5	3.0	3.00	1.00	75	225.0	75.0	0.75	0.25	1000	750.0	250.0	975.0	325.0
6	1.0	3.00	3.00	75	225.0	225.0	0.00	0.00		0.0	0.0	225.0	225.0
7	1.0	3.00	3.00	75	225.0	225.0	0.00	0.00		0.0	0.0	225.0	225.0
8	1.0	0.00	0.00		0.0	0.0	0.75	0.75	1000	750.0	750.0	750.0	750.0
9	5.0	15.00	3.00	100	1500.0	300.0	0.00	0.00		0.0	0.0	1500.0	300.0
10	4.0	10.00	2.50	75	750.0	187.5	0.00	0.00		0.0	0.0	750.0	187.5
11	3.0	6.00	2.00	75	450.0	150.0	0.00	0.00		0.0	0.0	450.0	150.0
12	2.0	7.00	3.50	80	560.0	280.0	0.00	0.00		0.0	0.0	560.0	280.0
13	2.0	5.00	2.50	80	400.0	200.0	0.50	0.25	1000	500.0	250.0	900.0	450.0
<b>AVG</b>			2.38			186.3		0.10			96.2		282.5
<b>S.D.</b>			0.92			77.3		0.21			208.9		156.1

## Sunflower Seed Propagation

### Table S-2 : Manuring

S. No.	Acre	LABOUR														MANURE		
		M.D.	M.D./ Ac.	Wage	Exp.	Exp./ Ac	F.D.	F.D./ Ac	Wage	Exp.	Exp./ Ac	P.D.	P.D./ Ac	Exp.	Exp./ Ac	Exp./ P.D.	Exp..	Exp./ AC.
1	5.0	5.0	1.0	20	100.0	20.0						5.0	1.0	100.0	20.0	20.0	3000.0	600.0
2	1.0	0.0	0.0		0.0	0.0						0.0	0.0	0.0	0.0		0.0	0.0
3	1.0	1.0	1.0	25	25.0	25.0						1.0	1.0	25.0	25.0	25.0	140.0	140.0
4	1.0	0.0	0.0		0.0	0.0						0.0	0.0	0.0	0.0		0.0	0.0
5	3.0	15.0	5.0	20	300.0	100.0						15.0	5.0	300.0	100.0	20.0	1800.0	600.0
6	1.0	3.0	3.0	20	60.0	60.0						3.0	3.0	60.0	60.0	20.0	600.0	600.0
7	1.0	2.0	2.0	25	50.0	50.0						2.0	2.0	50.0	50.0	25.0	480.0	480.0
8	1.0	5.0	5.0	25	125.0	125.0						5.0	5.0	125.0	125.0	25.0	700.0	700.0
9	5.0	10.0	2.0	20	200.0	40.0						10.0	2.0	200.0	40.0	20.0	3000.0	600.0
10	4.0	6.0	1.5	25	150.0	37.5						6.0	1.5	150.0	37.5	25.0	1500.0	375.0
11	3.0	4.0	1.3	20	80.0	26.7						4.0	1.3	80.0	26.7	20.0	1000.0	333.3
12	2.0	5.0	2.5	25	125.0	62.5						5.0	2.5	125.0	62.5	25.0	1000.0	500.0
13	2.0	5.0	2.5	25	125.0	62.5						5.0	2.5	125.0	62.5	25.0	1000.0	500.0
AVG			2.1	22.73		46.9							2.1		46.9	22.7		417.6
S.D.				2.49									1.5		34.8	2.5		226.2

## Sunflower Seed Propagation

### Table S-3 : Sowing

LABOUR																	SEED	
S. No.	Acres	M.D.	M.D./ Ac.	Wage	Exp.	Exp./ Ac	F.D.	F.D./ Ac	Wage	Exp.	Exp./ Ac	P.D.	P.D./ Ac	Exp.	Exp./ Ac	Exp./ P.D.	Seed Co.	Cost/ Ac.
1	5.0	20.0	4.0	20	400.0	80.0	0.0	0.0		0.0	0.0	20.0	4.0	400.0	80.0	20.0	CAR	500.0
2	1.0	0.0	0.0		0.0	0.0	2.0	2.0	20	40.0	40.0	2.0	2.0	40.0	40.0	20.0	MAH	350.0
3	1.0	0.0	0.0		0.0	0.0	2.0	2.0	20	40.0	40.0	2.0	2.0	40.0	40.0	20.0	MAH	350.0
4	1.0	0.0	0.0		0.0	0.0	2.0	2.0	20	40.0	40.0	2.0	2.0	40.0	40.0	20.0	MAH	350.0
5	3.0	0.0	0.0		0.0	0.0	15.0	5.0	15	225.0	75.0	15.0	5.0	225.0	75.0	15.0	MAH	350.0
6	1.0	0.0	0.0		0.0	0.0	6.0	6.0	15	90.0	90.0	6.0	6.0	90.0	90.0	15.0	EID	350.0
7	1.0	8.0	8.0	25	200.0	200.0	0.0	0.0		0.0	0.0	8.0	8.0	200.0	200.0	25.0	MAH	300.0
8	1.0	0.0	0.0		0.0	0.0	8.0	8.0	15	120.0	120.0	8.0	8.0	120.0	120.0	15.0	IAH	500.0
9	5.0	25.0	5.0	20	500.0	100.0	0.0	0.0		0.0	0.0	25.0	5.0	500.0	100.0	20.0	MAH	350.0
10	4.0	0.0	0.0		0.0	0.0	24.0	6.0	15	360.0	90.0	24.0	6.0	360.0	90.0	15.0	MAH	350.0
11	3.0	0.0	0.0		0.0	0.0	18.0	6.0	15	270.0	90.0	18.0	6.0	270.0	90.0	15.0	MAH	350.0
12	2.0	0.0	0.0		0.0	0.0	3.0	1.5	15	45.0	22.5	3.0	1.5	45.0	22.5	15.0	MAH	350.0
13	2.0	0.0	0.0		0.0	0.0	3.0	1.5	15	45.0	22.5	3.0	1.5	45.0	22.5	15.0	MAH	350.0
AVG			1.3	21.7		29.2		3.1	16.5		48.5		4.4		77.7	17.7		369.2
S.D.				2.4					2.3				2.3		46.5	3.2		57.3

## Sunflower Seed Propagation

### Table S-4 : Irrigation

LABOUR																
S. No.	Acres	M.D.	M.D./ Ac.	Wage	Exp.	Exp./ Ac	F.D.	F.D./ Ac	Wage	Exp.	Exp./ Ac	P.D.	P.D./ Ac	Exp.	Exp./ Ac	Exp./ P.D.
1	5.0	20.0	4.0	25	500.0	100.0						20.0	4.0	500.0	100.0	25.0
2	1.0	3.0	3.0	25	75.0	75.0						3.0	3.0	75.0	75.0	25.0
3	1.0	5.0	5.0	25	125.0	125.0						5.0	5.0	125.0	125.0	25.0
4	1.0	3.8	3.8	25	93.8	93.8						3.8	3.8	93.8	93.8	25.0
5	3.0	12.0	4.0	20	240.0	80.0						12.0	4.0	240.0	80.0	20.0
6	1.0	4.0	4.0	20	80.0	80.0						4.0	4.0	80.0	80.0	20.0
7	1.0	4.0	4.0	20	80.0	80.0						4.0	4.0	80.0	80.0	20.0
8	1.0	6.0	6.0	25	150.0	150.0						6.0	6.0	150.0	150.0	25.0
9	5.0	25.0	5.0	20	500.0	100.0						25.0	5.0	500.0	100.0	20.0
10	4.0	20.0	5.0	25	500.0	125.0						20.0	5.0	500.0	125.0	25.0
11	3.0	18.0	6.0	20	360.0	120.0						18.0	6.0	360.0	120.0	20.0
12	2.0	6.0	3.0	30	180.0	90.0						6.0	3.0	180.0	90.0	30.0
13	2.0	6.0	3.0	25	150.0	75.0						6.0	3.0	150.0	75.0	25.0
<b>AVG</b>			4.3	23.46		99.5							4.3		99.5	23.5
<b>S.D.</b>				3.03									1.0		22.8	3.0



## Sunflower Seed Propagation

### Table S-5: Weeding

LABOUR																
S. No.	Acres	M.D.	M.D./ Ac.	Wage	Exp.	Exp./ Ac	F.D.	F.D./ Ac	Wage	Exp.	Exp./ Ac	P.D.	P.D./ Ac	Exp.	Exp./ Ac	Exp./ PD
1	5.0	0.0	0.0		0.0	0.0	50.0	10.0	15	750.0	150.0	50.0	10.0	750.0	150.0	15.0
2	1.0	0.5	0.5	25	12.5	12.5	4.0	4.0	20	80.0	80.0	4.5	4.5	92.5	92.5	20.6
3	1.0	0.5	0.5	25	12.5	12.5	5.0	5.0	20	100.0	100.0	5.5	5.5	112.5	112.5	20.5
4	1.0	1.0	1.0	25	25.0	25.0	5.0	5.0	20	100.0	100.0	6.0	6.0	125.0	125.0	20.8
5	3.0	2.0	0.7	20	40.0	13.3	18.0	6.0	15	270.0	90.0	20.0	6.7	310.0	103.3	15.5
6	1.0	1.0	1.0	20	20.0	20.0	8.0	8.0	15	120.0	120.0	9.0	9.0	140.0	140.0	15.6
7	1.0	1.0	1.0	25	25.0	25.0	10.0	10.0	15	150.0	150.0	11.0	11.0	175.0	175.0	15.9
8	1.0	1.0	1.0	25	25.0	25.0	10.0	10.0	15	150.0	150.0	11.0	11.0	175.0	175.0	15.9
9	5.0	2.0	0.4	20	40.0	8.0	15.0	3.0	15	225.0	45.0	17.0	3.4	265.0	53.0	15.6
10	4.0	2.0	0.5	25	50.0	12.5	48.0	12.0	15	720.0	180.0	50.0	12.5	770.0	192.5	15.4
11	3.0	2.0	0.7	20	40.0	13.3	35.0	11.7	15	525.0	175.0	37.0	12.3	565.0	188.3	15.3
12	2.0	2.0	1.0	25	50.0	25.0	4.0	2.0	15	60.0	30.0	6.0	3.0	110.0	55.0	18.3
13	2.0	3.0	1.5	25	75.0	37.5	3.0	1.5	15	45.0	22.5	6.0	3.0	120.0	60.0	20.0
<b>AVG</b>			0.7	23.33		17.7		6.8	16.15		107.1		7.5		124.8	17.3
<b>S.D.</b>				2.36					2.11				3.4		48.4	2.3

**Table S-5 (Contd.): Weeding**

<b>BULLOCK &amp; TRACTOR</b>													
<b>S. No.</b>	<b>Acres</b>	<b>B.D.</b>	<b>B.D./ Ac.</b>	<b>Rate</b>	<b>Exp.</b>	<b>Exp./ Ac.</b>	<b>Total Days</b>	<b>Total days/Ac</b>	<b>Rate</b>	<b>Exp.</b>	<b>Exp./ Ac</b>	<b>Total Exp.</b>	<b>Total Exp./Ac</b>
1	5.0	2.50	0.50	75.0	188.0	37.6						188.0	37.6
2	1.0	0.50	0.50	75.0	37.5	37.5						37.5	37.5
3	1.0	0.50	0.50	75.0	37.5	37.5						37.5	37.5
4	1.0	1.00	1.00	75.0	75.0	75.0						75.0	75.0
5	3.0	2.00	0.67	75.0	150.0	50.0						150.0	50.0
6	1.0	0.50	0.50	75.0	37.5	37.5						37.5	37.5
7	1.0	1.00	1.00	75.0	75.0	75.0						75.0	75.0
8	1.0	1.00	1.00	75.0	75.0	75.0						75.0	75.0
9	5.0	2.00	0.40	100.0	200.0	40.0						200.0	40.0
10	4.0	2.00	0.50	75.0	150.0	37.5						150.0	37.5
11	3.0	2.00	0.67	75.0	150.0	50.0						150.0	50.0
12	2.0	2.00	1.00	80.0	160.0	80.0						160.0	80.0
13	2.0	3.00	1.50	80.0	240.0	120.0						240.0	120.0
<b>AVG</b>			0.75			57.9							57.9
<b>S.D.</b>			0.31			24.4							24.4

## Sunflower Seed Propagation

### Table S-6 : Application of Fertilizers

LABOUR																	Fertilizer	
S. No.	Acres	M.D.	M.D./ Ac.	Wage	Exp.	Exp./ Ac	F.D.	F.D./ Ac	Wage	Exp.	Exp./ Ac	P.D.	P.D./ Ac	Exp.	Exp./ Ac	Exp./ P.D.	Exp.	Exp./ Ac.
1	5.0	5.0	1.0	20	100.0	20.0						5.0	1.0	100.0	20.0	20.0	5975.0	1195.0
2	1.0	1.0	1.0	25	25.0	25.0						1.0	1.0	25.0	25.0	25.0	580.0	580.0
3	1.0	0.5	0.5	25	12.5	12.5						0.5	0.5	12.5	12.5	25.0	760.0	760.0
4	1.0	2.0	2.0	25	50.0	50.0						2.0	2.0	50.0	50.0	25.0	750.0	750.0
5	3.0	3.0	1.0	20	60.0	20.0						3.0	1.0	60.0	20.0	20.0	2325.0	775.0
6	1.0	2.0	2.0	20	40.0	40.0						2.0	2.0	40.0	40.0	20.0	775.0	775.0
7	1.0	2.0	2.0	25	50.0	50.0						2.0	2.0	50.0	50.0	25.0	775.0	775.0
8	1.0	3.0	3.0	25	75.0	75.0						3.0	3.0	75.0	75.0	25.0	665.0	665.0
9	5.0	5.0	1.0	20	100.0	20.0						5.0	1.0	100.0	20.0	20.0	4275.0	855.0
10	4.0	5.0	1.3	25	125.0	31.3						5.0	1.3	125.0	31.3	25.0	2310.0	577.5
11	3.0	3.0	1.0	20	60.0	20.0						3.0	1.0	60.0	20.0	20.0	1720.0	573.3
12	2.0	1.0	0.5	25	25.0	12.5						1.0	0.5	25.0	12.5	25.0	900.0	450.0
13	2.0	2.0	1.0	25	50.0	25.0						2.0	1.0	50.0	25.0	25.0	750.0	375.0
AVG			1.3	23.08		30.9							1.3		30.9	23.1		700.4
S.D.				2.43									0.7		17.5	2.4		197.4

### Sunflower Seed Propagation

**Table S-7 : Application of Pesticides**

LABOUR																
S. No.	Acres	M.D.	M.D./ Ac.	Wage	Exp.	Exp./ Ac	F.D.	F.D./ Ac	Wage	Exp.	Exp./ Ac	P.D.	P.D./ Ac	Exp.	Exp./ Ac	Exp./ P.D.
1	5.0	20.0	4.0	25	500.0	100.0						20.0	4.0	500.0	100.0	25.0
2	1.0	3.0	3.0	25	75.0	75.0						3.0	3.0	75.0	75.0	25.0
3	1.0	5.0	5.0	25	125.0	125.0						5.0	5.0	125.0	125.0	25.0
4	1.0	3.8	3.8	25	93.8	93.8						3.8	3.8	93.8	93.8	25.0
5	3.0	12.0	4.0	20	240.0	80.0						12.0	4.0	240.0	80.0	20.0
6	1.0	4.0	4.0	20	80.0	80.0						4.0	4.0	80.0	80.0	20.0
7	1.0	4.0	4.0	20	80.0	80.0						4.0	4.0	80.0	80.0	20.0
8	1.0	6.0	6.0	25	150.0	150.0						6.0	6.0	150.0	150.0	25.0
9	5.0	25.0	5.0	20	500.0	100.0						25.0	5.0	500.0	100.0	20.0
10	4.0	20.0	5.0	25	500.0	125.0						20.0	5.0	500.0	125.0	25.0
11	3.0	18.0	6.0	20	360.0	120.0						18.0	6.0	360.0	120.0	20.0
12	2.0	6.0	3.0	30	180.0	90.0						6.0	3.0	180.0	90.0	30.0
13	2.0	6.0	3.0	25	150.0	75.0						6.0	3.0	150.0	75.0	25.0
AVG			4.3	23.46		99.5							4.3		99.5	23.5
S.D.				3.03									1.0		22.8	3.0

## Sunflower Seed Propagation

**Table S-8 : Cross-Pollination**

LABOUR																
S. No.	Acres	M.D.	M.D./ Ac.	Wage	Exp.	Exp/ Ac.	F.D.	F.D./ Ac	Wage	Exp.	Exp/ Ac	P.D.	P.D./ Ac	Exp.	Exp/ Ac	Exp/ P.D.
1	5.0	100.0	20.0	20	2000.0	400.0	0.0	0.0		0.0	0.0	100.0	20.0	2000.0	400.0	20.0
2	1.0	20.0	20.0	25	500.0	500.0	0.0	0.0		0.0	0.0	20.0	20.0	500.0	500.0	25.0
3	1.0	0.0	0.0		0.0	0.0	25.0	25.0	20	500.0	500.0	25.0	25.0	500.0	500.0	20.0
4	1.0	0.0	0.0		0.0	0.0	20.0	20.0	20	400.0	400.0	20.0	20.0	400.0	400.0	20.0
5	3.0	0.0	0.0		0.0	0.0	45.0	15.0	15	675.0	225.0	45.0	15.0	675.0	225.0	15.0
6	1.0	0.0	0.0		0.0	0.0	15.0	15.0	15	225.0	225.0	15.0	15.0	225.0	225.0	15.0
7	1.0	0.0	0.0		0.0	0.0	20.0	20.0	15	300.0	300.0	20.0	20.0	300.0	300.0	15.0
8	1.0	21.0	21.0	20	420.0	420.0	0.0	0.0		0.0	0.0	21.0	21.0	420.0	420.0	20.0
9	5.0	0.0	0.0		0.0	0.0	75.0	15.0	15	1125.0	225.0	75.0	15.0	1125.0	225.0	15.0
10	4.0	0.0	0.0		0.0	0.0	60.0	15.0	15	900.0	225.0	60.0	15.0	900.0	225.0	15.0
11	3.0	0.0	0.0		0.0	0.0	45.0	15.0	15	675.0	225.0	45.0	15.0	675.0	225.0	15.0
12	2.0	0.0	0.0		0.0	0.0	25.0	12.5	15	375.0	187.5	25.0	12.5	375.0	187.5	15.0
13	2.0	0.0	0.0		0.0	0.0	30.0	15.0	15	450.0	225.0	30.0	15.0	450.0	225.0	15.0
<b>AVG</b>			4.7	21.67		101.5		12.9	16.00		210.6		17.6		312.1	17.3
<b>S.D.</b>				2.36					2.00				3.5		110.6	3.2

### Sunflower Seed Propagation

**Table S-9 : Watch & Ward**

LABOUR																
S. No.	Acres	M.D.	M.D./ Ac.	Wage	Exp.	Exp./ Ac	F.D.	F.D./ Ac	Wage	Exp.	Exp./ Ac	P.D.	P.D./ Ac	Exp.	Exp./ Ac	Exp./ P.D.
1	5.0						15.0	3.0	20	300.0	60.0	15.0	3.0	300.0	60.0	20.0
2	1.0						7.5	7.5	20	150.0	150.0	7.5	7.5	150.0	150.0	20.0
3	1.0						7.5	7.5	20	150.0	150.0	7.5	7.5	150.0	150.0	20.0
4	1.0						7.5	7.5	20	150.0	150.0	7.5	7.5	150.0	150.0	20.0
5	3.0						7.5	2.5	20	150.0	50.0	7.5	2.5	150.0	50.0	20.0
6	1.0						7.5	7.5	20	150.0	150.0	7.5	7.5	150.0	150.0	20.0
7	1.0						7.5	7.5	20	150.0	150.0	7.5	7.5	150.0	150.0	20.0
8	1.0						7.5	7.5	20	150.0	150.0	7.5	7.5	150.0	150.0	20.0
9	5.0						15.0	3.0	20	300.0	60.0	15.0	3.0	300.0	60.0	20.0
10	4.0						15.0	3.8	20	300.0	75.0	15.0	3.8	300.0	75.0	20.0
11	3.0						7.5	2.5	20	150.0	50.0	7.5	2.5	150.0	50.0	20.0
12	2.0						7.5	3.8	15	112.5	56.3	7.5	3.8	112.5	56.3	15.0
13	2.0						7.5	3.8	15	112.5	56.3	7.5	3.8	112.5	56.3	15.0
AVG								5.2	19.23		100.6		5.2		100.6	19.2
S.D.									1.80				2.2		46.1	1.8

## Sunflower Seed Propagation

### Table S-10 : Harvesting & Processing

LABOUR																		
S.No.	Acres	M.D.	M.D./ Ac.	Wage	Exp.	Exp./ Ac	F.D.	F.D./ Ac	Wage	Exp.	Exp./ Ac	P.D.	P.D./ Ac	Exp.	Exp./ Ac	Exp./ P.D.	PD/Kg	Kg/ PD
1	5.0	0.0	0.0		0.0	0.0	100.0	20.0	20	2000.0	400.0	100.0	20.0	2000.0	400.0	20.0	0.04	23.0
2	1.0	0.0	0.0		0.0	0.0	14.0	14.0	20	280.0	280.0	14.0	14.0	280.0	280.0	20.0	0.06	15.7
3	1.0	0.0	0.0		0.0	0.0	15.0	15.0	20	300.0	300.0	15.0	15.0	300.0	300.0	20.0	0.06	16.0
4	1.0	0.0	0.0		0.0	0.0	17.0	17.0	20	340.0	340.0	17.0	17.0	340.0	340.0	20.0	0.09	11.8
5	3.0	12.0	4.0	20	240.0	80.0	18.0	6.0	15	270.0	90.0	30.0	10.0	510.0	170.0	17.0	0.03	32.0
6	1.0	3.0	3.0	20	60.0	60.0	16.0	16.0	15	240.0	240.0	19.0	19.0	300.0	300.0	15.8	0.03	36.8
7	1.0	4.0	4.0	25	100.0	100.0	6.0	6.0	15	90.0	90.0	10.0	10.0	190.0	190.0	19.0	0.08	13.0
8	1.0	8.0	8.0	25	200.0	200.0	12.0	12.0	15	180.0	180.0	20.0	20.0	380.0	380.0	19.0	0.04	27.5
9	5.0	65.0	13.0	20	1300.0	260.0	0.0	0.0		0.0	0.0	65.0	13.0	1300.0	260.0	20.0	0.04	26.2
10	4.0	16.0	4.0	25	400.0	100.0	52.0	13.0	15	780.0	195.0	68.0	17.0	1180.0	295.0	17.4	0.05	19.1
11	3.0	6.0	2.0	20	120.0	40.0	39.0	13.0	15	585.0	195.0	45.0	15.0	705.0	235.0	15.7	0.08	13.3
12	2.0	4.0	2.0	25	100.0	50.0	24.0	12.0	15	360.0	180.0	28.0	14.0	460.0	230.0	16.4	0.07	14.3
13	2.0	0.0	0.0		0.0	0.0	22.0	11.0	16	343.8	171.9	22.0	11.0	343.8	171.9	15.6	0.06	16.8
<b>AVG</b>			3.1	22.50		68.5		11.9	16.72		204.8		15.0		273.2	18.1	0.06	20.4
<b>S.D.</b>				2.50					2.33				3.4		70.8	1.8	0.02	7.7

### Sunflower Seed Propagation

**Table S-11 : Labour Summary**

S.No.	Acres	M.D.	M.D./ Ac.	Exp.	Exp./ Ac	Exp./ MD	F.D.	F.D./Ac	Exp.	Exp./ Ac	Exp/ FD	P.D.	PD/Ac	Exp.	Exp./ Ac	Exp./ PD
1	5.0	155.0	31.0	3200.0	640.0	20.6	165.0	33.0	3050.0	610.0	18.5	320.0	64.0	6250.0	1250.0	19.5
2	1.0	25.5	25.5	637.5	637.5	25.0	29.5	29.5	590.0	590.0	20.0	55.0	55.0	1227.5	1227.5	22.3
3	1.0	7.5	7.5	187.5	187.5	25.0	58.5	58.5	1170.0	1170.0	20.0	66.0	66.0	1357.5	1357.5	20.6
4	1.0	7.8	7.8	193.8	193.8	25.0	55.5	55.5	1110.0	1110.0	20.0	63.3	63.3	1303.8	1303.8	20.6
5	3.0	50.0	16.7	1000.0	333.3	20.0	103.5	34.5	1590.0	530.0	15.4	153.5	51.2	2590.0	863.3	16.9
6	1.0	15.0	15.0	300.0	300.0	20.0	52.5	52.5	825.0	825.0	15.7	67.5	67.5	1125.0	1125.0	16.7
7	1.0	23.0	23.0	555.0	555.0	24.1	43.5	43.5	690.0	690.0	15.9	66.5	66.5	1245.0	1245.0	18.7
8	1.0	46.0	46.0	1045.0	1045.0	22.7	37.5	37.5	600.0	600.0	16.0	83.5	83.5	1645.0	1645.0	19.7
9	5.0	142.0	28.4	2840.0	568.0	20.0	105.0	21.0	1650.0	330.0	15.7	247.0	49.4	4490.0	898.0	18.2
10	4.0	55.0	13.8	1375.0	343.8	25.0	199.0	49.8	3060.0	765.0	15.4	254.0	63.5	4435.0	1108.8	17.5
11	3.0	37.0	12.3	740.0	246.7	20.0	144.5	48.2	2205.0	735.0	15.3	181.5	60.5	2945.0	981.7	16.2
12	2.0	19.0	9.5	505.0	252.5	26.6	67.5	33.8	1012.5	506.3	15.0	86.5	43.3	1517.5	758.8	17.5
13	2.0	17.0	8.5	425.0	212.5	25.0	69.5	34.8	1056.3	528.1	15.2	86.5	43.3	1481.3	740.6	17.1
<b>AVG</b>			18.8		424.3	23.0		40.9		691.5	16.8		59.8		1115.8	18.6
<b>S.D.</b>			11.0		241.8	2.4		10.8		227.4	2.0		10.7		250.9	1.8



## Sunflower Seed Propagation

**Table S-12: Mechanical Energy Summary**

S. No.	Acres	B.D.	B.D./Ac.	Rate	Exp.	Exp./Ac.	Total days	Total days/Ac	Rate	Exp.	Exp./Ac	Total exp.	Total exp./Ac
1.	5	14.5	2.90	75	1088	217.5	0	0		0	0	1087.5	217.5
2.	1	3.5	3.50	75	262.5	262.5	0	0		0	0	262.5	262.5
3.	1	2.5	2.50	75	187.5	187.5	0	0		0	0	187.5	187.5
4.	1	4.0	4.00	75	300	300	0	0		0	0	300	300
5.	3	5.0	1.67	75	375	125	0.75	0.25	1000	750	250	1125	375
6.	1	3.5	3.50	75	262.5	262.5	0	0		0	0	262.5	262.5
7.	1	4.0	4.00	75	300	300	0	0		0	0	300	300
8.	1	1.0	1.00	75	75	75	0.75	0.75	1000	750	750	825	825
9.	5	17.0	3.40	100	1700	340	0	0		0	0	1700	340
10.	4	12.0	3.00	75	900	225	0	0		0	0	900	225
11.	3	8.0	2.67	75	600	200	0	0		0	0	600	200
12.	2	9.0	4.50	80	720	360	0	0		0	0	720	360
13.	2	8.0	4.00	80	640	320	0.5	0.25	1000	500	250	1140	570
<b>AVG</b>			3.13			244.23		0.10			96.15		340.38
<b>S.D.</b>			0.96			80.54		0.21			208.90		170.08

## Sunflower Seed Propagation

**Table S-13: Surplus of Revenue over Total Variable Cost**

S. No.	Acres	Variable input cost per unit area						Total var. cost per acre	TR1/Acre	TR2/Acre	TR/Acre	Surplus per acre	% surplus to TR
		Labour	Mech. energy	Manure	Seed	Fertilizer	Pesticides						
1	5	1250	218	600	500	1195	325	4088	15200	600	15800	11713	74.13
2	1	1228	263	0	350	580	85	2505	5400	480	5880	3375	57.40
3	1	1358	188	140	350	760	55	2850	6000	440	6440	3590	55.75
4	1	1304	300	0	350	750	110	2814	4500	600	5100	2286	44.83
5	3	863	375	600	350	775	170	3133	7500	840	8340	5207	62.43
6	1	1125	263	600	350	775	270	3383	18000	1000	19000	15618	82.20
7	1	1245	300	480	300	775	250	3350	1500	880	2380	-970	-40.76
8	1	1645	825	700	500	665	200	4535	11400	2500	13900	9365	67.37
9	5	898	340	600	350	855	160	3203	9000	440	9440	6237	66.07
10	4	1109	225	375	350	578	180	2816	8250	600	8850	6034	68.18
11	3	982	200	333	350	573	180	2618	5000	396	5396	2778	51.48
12	2	759	360	500	350	450	40	2459	4500	550	5050	2591	51.31
13	2	741	570	500	350	375	113	2648	3750	660	4410	1762	39.95
<b>Avg.</b>	2.31	1116	340	418	369	700	164	3108	7692	768	8460	5353	52.33
<b>S.D.</b>	1.49	251	170	226	57	197	81	596	4541	530	4740	4356	29.15
<b>C.V.</b>	0.64	0.22	0.50	0.54	0.16	0.28	0.49	0.19	0.59	0.69	0.56	0.81	0.56

## Chillies + Cotton

### Table C-1: Land Preparation

<b>Labour</b>																
S. No.	Acres	MD	MD/ Ac.	Wage	Exp.	Exp/ Ac.	FD	FD/ Ac.	Wage	Exp.	Exp/ Ac	PD	PD/ Ac.	Exp.	Exp/ Ac	Exp/ PD
1	64.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.00	0.0	0.00	0.0	0.00	
2	21.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.00	0.0	0.00	0.0	0.00	
3	24.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.00	0.0	0.00	0.0	0.00	
4	3.5	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.00	0.0	0.00	0.0	0.00	
5	3.5	2.0	0.6	20.0	40.0	11.4	8.0	2.3	20.0	160.0	45.71	10.0	2.86	200.0	57.14	20.00
6	16.0	0.0	0.0		0.0	0.0	16.0	1.0	15.0	240.0	15.00	16.0	1.00	240.0	15.00	15.00
7	1.5	0.0	0.0		0.0	0.0	2.0	1.3	15.0	30.0	20.00	2.0	1.33	30.0	20.00	15.00
8	2.5	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.00	0.0	0.00	0.0	0.00	
9	3.0	4.0	1.3	25.00	100.0	33.3	4.0	1.3	15.0	60.0	20.00	8.0	2.67	160.0	53.33	20.00
10	4.0	0.0	0.0		0.0	0.0	4.0	1.0	15.0	60.0	15.00	4.0	1.00	60.0	15.00	15.00
<b>AVG</b>			0.19	22.50		4.48		0.70	16.00		11.57		0.89		16.05	17.00
<b>S.D.</b>													1.06		20.94	2.45

**Table C-1 (Contd.): Land Preparation**

<b>Bullock &amp; Tractor</b>													
S. No.	Acres	B.D.	B.D./ Ac.	Rate	Exp.	Exp/ Ac.	Total days	Total days/Ac	Rate	Exp.	Exp/ Ac.	Total exp.	Exp/ Ac
1	64.0	21.00	0.3	75.0	1575.0	24.61	16.00	0.25	1000	16000	250.00	17575.00	274.61
2	21.0	7.00	0.3	75.0	525.0	25.00	5.25	0.25	1000	5250	250.00	5775.00	275.00
3	24.0	12.00	0.5	75.0	900.0	37.50	10.00	0.42	1000	10000	416.67	10900.00	454.17
4	3.5	11.00	3.1	100.0	1100.0	314.29	0.00	0.00		0	0.00	1100.00	314.29
5	3.5	7.00	2.0	100.0	700.0	200.00	0.88	0.25	1000	875	250.00	1575.00	450.00
6	16.0	18.00	1.1	80.0	1440.0	90.00	4.00	0.25	900	3600	225.00	5040.00	315.00
7	1.5	3.00	2.0	80.0	240.0	160.00	0.38	0.25	800	300	200.00	540.00	360.00
8	2.5	1.00	0.4	75.0	75.0	30.00	1.00	0.40	1000	1000	400.00	1075.00	430.00
9	3.0	13.75	4.6	75.0	1031.25	343.75	0.00	0.00		0	0.00	1031.25	343.75
10	4.0	9.00	2.3	75.0	675.0	168.75	1.00	0.25	1000	1000	250.00	1675.00	418.75
<b>AVG.</b>		10.28	1.67	81.00		139.39		0.23	962.50		224.17		363.56
<b>S.D.</b>		5.94	1.34	9.70		113.30		0.13	69.60		131.05		66.40

## Chillies + Cotton

### Table C-2: Manuring

Labour																	Manure	
S. No.	Acres	MD	MD/Ac.	Wage	Exp.	Exp/Ac.	FD	FD/Ac.	Wage	Exp.	Exp/Ac.	PD	PD/Ac.	Exp.	Exp/Ac.	Exp/PD	Exp.	Exp/Ac
1	64.0	50	0.78	25	1250	19.53						50	0.78	1250	19.53	25.00	10250	160.16
2	21.0	21	1.00	30	630	30.00						21	1.00	630	30.00	30.00	9450	450.00
3	24.0	6	0.25	25	150	6.25						6	0.25	150	6.25	25.00	900	37.50
4	3.5	2	0.57	25	50	14.29						2	0.57	50	14.29	25.00	250	71.43
5	3.5	5	1.43	25	125	35.71						5	1.43	125	35.71	25.00	1400	400.00
6	16.0	20	1.25	20	400	25.00						20	1.25	400	25.00	20.00	1200	75.00
7	1.5	2	1.33	20	40	26.67						2	1.33	40	26.67	20.00	300	200.00
8	2.5	2	0.80	25	50	20.00						2	0.80	50	20.00	25.00	375	150.00
9	3.0	3	1.00	25	75	25.00						3	1.00	75	25.00	25.00	300	100.00
10	4.0	6	1.50	20	120	30.00						6	1.50	120	30.00	20.00	1500	375.00
<b>AVG</b>			0.99	24.00		23.24							0.99		23.24	24.00	201.91	
<b>S.D.</b>													0.38		8.11	3.00	143.44	

## Chillies + Cotton

### Table C-3 : Sowing / Transplanting

Labour															
S. No.	Acres	MD	MD/Ac	Wage	Exp.	Exp/Ac.	FD	FD/Ac.	Wage	Exp.	Exp/Ac	PD	PD/Ac.	Exp.	Exp/Ac
1	64.0	54.00	0.84	25	1350.00	21.09	512	8.00	15	7680	120.00	566.00	8.84	9030.00	141.09
2	21.0	14.00	0.67	30	420.00	20.00	105	5.00	20	2100	100.00	119.00	5.67	2520.00	120.00
3	24.0	28.00	1.17	25	700.00	29.17	168	7.00	25	4200	175.00	196.00	8.17	4900.00	204.17
4	3.5	3.50	1.00	25	87.50	25.00	30	8.57	20	600	171.43	33.50	9.57	687.50	196.43
5	3.5	2.50	0.71	25	62.50	17.86	21	6.00	20	420	120.00	23.50	6.71	482.50	137.86
6	16.0	5.00	0.31	20	100.00	6.25	85	5.31	15	1275	79.69	90.00	5.63	1375.00	85.94
7	1.5	3.50	2.33	20	70.00	46.67	14	9.33	15	210	140.00	17.50	11.67	280.00	186.67
8	2.5	1.50	0.60	25	37.50	15.00	8	3.20	15	120	48.00	9.50	3.80	157.50	63.00
9	3.0	2.50	0.83	25	62.50	20.83	27	9.00	15	405	135.00	29.50	9.83	467.50	155.83
10	4.0	5.00	1.25	20	100.00	25.00	39	9.75	15	585	146.25	44.00	11.00	685.00	171.25
AVG.			0.97	24.00		22.69		7.12	17.50		123.54		8.09		146.22
S.D.													2.44		44.25

Table C.3 (Contd.): Sowing / Transplanting

Seed															
S. No.	Acres	CHILLIES						COTTON						TOTAL	
		Variety	Kg	Kg/Ac.	Price/Kg	Cost	Cost/Ac.	Variety	Kg	Kg/Ac.	Price/Kg	Cost	Cost/Ac.	Total cost	Cost/Ac.
1	64.0	DEVANUR	32.0	0.50	150.00	4800.00	75.00	JAYADIAR	128	2.00	8	1024	16.00	5824.00	91.00
2	21.0	DEVANUR	21.0	1.00	30.00	630.00	30.00	JAYADIAR	42	2.00	7	294	14.00	924.00	44.00
3	24.0	ANNIGERY	14.4	0.60	40.00	576.00	24.00	JAYADIAR	48	2.00	7	336	14.00	912.00	38.00
4	3.5	BYADAGI	2.5	0.71	40.00	100.00	28.57	JAYADIAR	8	2.29	8	64	18.29	164.00	46.86
5	3.5	DEVANUR	2.5	0.71	40.00	100.00	28.57	JAYADIAR	7	2.00	15	105	30.00	205.00	58.57
6	16.0	DEVANUR	16.0	1.00	30.00	480.00	30.00	JAYADIAR	48	3.00	6	288	18.00	768.00	48.00
7	1.5	DEVANUR	1.5	1.00	30.00	45.00	30.00	JAYADIAR	3	2.00	8	24	32.00	69.00	46.00
8	2.5	DABBY	2.0	0.80	35.00	70.00	28.00	JAYADIAR	5	2.00	6	30	12.00	100.00	40.00
9	3.0	DEVANUR	3.0	1.00	25.00	75.00	25.00	JAYADIAR	7	2.33	15	105	35.00	180.00	60.00
10	4.0	DEVANUR	4.0	1.00	33.33	133.33	33.33	JAYADIAR	8	2.00	16	128	32.00	261.33	65.33
AVG				0.83			33.25			2.16			22.13		53.78
S.D.				0.18			14.14			0.31			8.52		15.02

**Chillies + Cotton**

**Table C-4: Weeding**

LABOUR																
S.N o.	Acres	MD	MD/ Ac.	Wage	Exp.	Exp./ Ac.	FD	FD/ Ac.	Wage	Exp.	Exp./ Ac.	PD	PD/ Ac.	Exp.	Exp./ Ac.	Exp./ PD
1	64.0						512.00	8.00	15.0	7680	120.00	512.0	8.00	7680.0	120.00	15.00
2	21.0						252.00	12.00	20.0	5040	240.00	252.0	12.00	5040.0	240.00	20.00
3	24.0						480.00	20.00	20.0	9600	400.00	480.0	20.00	9600.0	400.00	20.00
4	3.5						6.00	1.71	20.0	120	34.29	6.0	1.71	120.0	34.29	20.00
5	3.5						12.00	3.43	20.0	240	68.57	12.0	3.43	240.0	68.57	20.00
6	16.0						32.00	2.00	15.0	480	30.00	32.0	2.00	480.0	30.00	15.00
7	1.5						4.00	2.67	15.0	60	40.00	4.0	2.67	60.0	40.00	15.00
8	2.5						30.00	12.00	15.0	450	180.00	30.0	12.00	450.0	180.00	15.00
9	3.0						5.00	1.67	15.0	75	25.00	5.0	1.67	75.0	25.00	15.00
10	4.0						40.00	10.00	15.0	600	150.00	40.0	10.00	600.0	150.00	15.00
AVG								7.28	17.22		129.76		7.28		129.76	17.22
S.D.													6.15		120.17	2.48



## Chillies + Cotton

### Table C-5 : Fertilizer Application

LABOUR																	FERTILIZER	
S. No.	Acres	MD	MD/Ac.	Wage	Exp.	Exp./Ac.	FD	FD/Ac.	Wage	Exp.	Exp./Ac	PD	PD/Ac.	Exp.	Exp./Ac	Exp./PD	Exp.	Exp./Acres
1	64.0	64	1.00	25	1600	25.00	0	0.00		0	0.00	64	1.00	1600	25.00	25.00	16000.00	250.00
2	21.0	10	0.48	30	300	14.29	0	0.00		0	0.00	10	0.48	300	14.29	30.00	10679.00	508.52
3	24.0	48	2.00	25	1200	50.00	0	0.00		0	0.00	48	2.00	1200	50.00	25.00	6480.00	270.00
4	3.5	2	0.57	25	50	14.29	0	0.00		0	0.00	2	0.57	50	14.29	25.00	1140.00	325.71
5	3.5	0	0.00		0	0.00	6	1.71	20	120	34.29	6	1.71	120	34.29	20.00	1635.00	467.14
6	16.0	0	0.00		0	0.00	10	0.63	15	150	9.38	10	0.63	150	9.38	15.00	3900.00	243.75
7	1.5	2	1.33	25	50	33.33	0	0.00		0	0.00	2	1.33	50	33.33	25.00	880.00	586.67
8	2.5	0	0.00		0	0.00	5	2.00	15	75	30.00	5	2.00	75	30.00	15.00	730.00	292.00
9	3.0	0	0.00		0	0.00	5	1.67	15	75	25.00	5	1.67	75	25.00	15.00	949.98	316.66
10	4.0	8	2.00	20	160	40.00	0	0.00		0	0.00	8	2.00	160	40.00	20.00	1900.00	475.00
<b>AVG</b>			0.74	25.00		17.69		0.60	16.25		9.87		1.34		27.56	21.50		373.55
<b>S.D.</b>													0.59		12.00	5.02		117.35

**Chillies + Cotton**

**Table C-6 : Pesticide Application**

LABOUR																	PESTICIDE	
S. No.	Acres	MD	MD/Ac.	Wage	Exp.	Exp./Ac.	FD	FD/Ac.	Wage	Exp.	Exp./Ac.	PD	PD/Ac.	Exp.	Exp./Ac.	Exp./PD	Exp	Exp./acre
1	64.0	0	0.0		0	0.0						0	0.0	0	0		0	0.00
2	21.0	0	0.0		0	0.0						0	0.0	0	0		0	0.00
3	24.0	12	0.5	25	300	12.5						12	0.5	300	12.5	25.0	1300	54.17
4	3.5	0	0.0		0	0.0						0	0.0	0	0		0	0.00
5	3.5	0	0.0		0	0.0						0	0.0	0	0		0	0.00
6	16.0	0	0.0		0	0.0						0	0.0	0	0		0	0.00
7	1.5	0	0.0		0	0.0						0	0.0	0	0		0	0.00
8	2.5	0	0.0		0	0.0						0	0.0	0	0		0	0.00
9	3.0	0	0.0		0	0.0						0	0.0	0	0		0	0.00
10	4.0	0	0.0		0	0.0						0	0.0	0	0		0	0.00
AVG			0.05	25.00		1.25							0.05		1.25	25.0		5.42
S.D.													0.15		3.75	0.0		

**Chillies + Cotton**

**Table C-7 : Harvesting & Processing (Chillies)**

LABOUR																		
S.N o.	Acres	MD	MD/ Ac.	Wage	Exp.	Exp./ Ac.	FD	FD/ Ac.	Wage	Exp.	Exp./ Ac	PD	PD/ Ac.	Exp.	Exp./ Ac	Exp./ PD	PD/ Kg	Kg./P D
1	64.0						384	6.00	15	5760	90.00	384	6.00	5760	90.00	15.00	0.08	13.02
2	21.0						105	5.00	20	2100	100.00	105	5.00	2100	100.00	20.00	0.11	9.52
3	24.0						360	15.00	20	7200	300.00	360	15.00	7200	300.00	20.00	0.08	12.50
4	3.5						25	7.14	20	500	142.86	25	7.14	500	142.86	20.00	0.06	16.00
5	3.5						27	7.71	20	540	154.29	27	7.71	540	154.29	20.00	0.08	12.96
6	16.0						80	5.00	15	1200	75.00	80	5.00	1200	75.00	15.00	0.13	7.50
7	1.5						14	9.33	15	210	140.00	14	9.33	210	140.00	15.00	0.09	10.71
8	2.5						23	9.20	15	345	138.00	23	9.20	345	138.00	15.00	0.06	17.39
9	3.0						20	6.67	15	300	100.00	20	6.67	300	100.00	15.00	0.07	15.00
10	4.0						22	5.50	15	330	82.50	22	5.50	330	82.50	15.00	0.06	18.18
AVG								7.66	17.00		132.26		7.66		132.26	17.00	0.08	13.28
S.D.									2.45				2.86		62.01	2.45	0.02	3.26

**Cillies + Cotton**

**Table C-8 : Harvesting & Processing (Cotton)**

<b>Labour</b>																		
S. No.	Acres	MD	MD/Ac.	Wage	Exp.	Exp./Ac.	FD	FD/Ac	Wage	Exp.	Exp./Ac	PD	PD/Ac.	Exp.	Exp./Ac.	Exp./FD	PD/Kg	Kg/PD
1	64.0						400.0	6.25	30	12000.0	187.50	400.0	6.25	12000.0	187.50	30.00	0.05	20.00
2	21.0						300.0	14.29	25	7500.0	357.14	300.0	14.29	7500.0	357.14	25.00	0.05	20.00
3	24.0						450.0	18.75	30	13500.0	562.50	450.0	18.75	13500.0	562.50	30.00	0.05	20.00
4	3.5						30.0	8.57	30	900.0	257.14	30.0	8.57	900.0	257.14	30.00	0.05	20.00
5	3.5						35.0	10.00	30	1050.0	300.00	35.0	10.00	1050.0	300.00	30.00	0.05	20.00
6	16.0						9.0	0.56	30	270.0	16.88	9.0	0.56	270.0	16.88	30.00	0.05	20.00
7	1.5						5.0	3.33	30	150.0	100.00	5.0	3.33	150.0	100.00	30.00	0.05	20.00
8	2.5						17.5	7.00	20	350.0	140.00	17.5	7.00	350.0	140.00	20.00	0.05	20.00
9	3.0						6.0	2.00	30	180.0	60.00	6.0	2.00	180.0	60.00	30.00	0.05	20.00
10	4.0						5.0	1.25	30	150.0	37.50	5.0	1.25	150.0	37.50	30.00	0.05	20.00
<b>AVG</b>								7.20	28.50		201.87		7.20		201.87	28.50	0.05	20.00
<b>S.D.</b>									3.20				5.62		162.06	3.20	0.00	0.00

**Chillies + Contton**

**Table C-9 : Labour Summary**

S. No.	Acres	MD	MD/ Ac.	Exp.	Exp./ Ac.	Exp./ MD	FD	FD/ Ac.	Exp.	Exp./ Ac	Exp./ FD	PD	PD/ Ac.	Exp.	Exp./ Ac.	Exp./ PD
1	64.0	168.00	2.63	4200.00	65.63	25.00	1808.00	28.25	33120.0	517.50	18.32	1976.00	30.88	37320.00	583.13	18.89
2	21.0	45.00	2.14	1350.00	64.29	30.00	762.00	36.29	16740.0	797.14	21.97	807.00	38.43	18090.00	861.43	22.42
3	24.0	94.00	3.92	2350.00	97.92	25.00	1458.00	60.75	34500.0	1437.50	23.66	1552.00	64.67	36850.00	1535.42	23.74
4	3.5	7.50	2.14	187.50	53.57	25.00	91.00	26.00	2120.0	605.71	23.30	98.50	28.14	2307.50	659.29	23.43
5	3.5	9.50	2.71	227.50	65.00	23.95	109.00	31.14	2530.0	722.86	23.21	118.50	33.86	2757.50	787.86	23.27
6	16.0	25.00	1.56	500.00	31.25	20.00	232.00	14.50	3615.0	225.94	15.58	257.00	16.06	4115.00	257.19	16.01
7	1.5	7.50	5.00	160.00	106.67	21.33	39.00	26.00	660.0	440.00	16.92	46.50	31.00	820.00	546.67	17.63
8	2.5	3.50	1.40	87.50	35.00	25.00	83.50	33.40	1340.0	536.00	16.05	87.00	34.80	1427.50	571.00	16.41
9	3.0	9.50	3.17	237.50	79.17	25.00	67.00	22.33	1095.0	365.00	16.34	76.50	25.50	1332.50	444.17	17.42
10	4.0	19.00	4.75	380.00	95.00	20.00	110.00	27.50	1725.0	431.25	15.68	129.00	32.25	2105.00	526.25	16.32
AVG			2.94		69.35	24.03		30.62		607.89	19.10		33.56		677.24	19.55
S.D.			1.19		24.29	2.83		11.55		318.58	3.31		11.87		327.68	3.10

### Chillies + Cotton

**Table C-10: Mechanical Energy Summary**

S.No.	Acres	B.D.	B.D./Ac.	Exp.	Exp/Ac.	Total days	Total days/ Ac.	Exp.	Axp/Ac.	Total exp.	Total exp/Ac.
1.	64.0	53.00	0.83	3975.00	62.11	16.00	0.25	16000.00	250.00	19975.00	312.11
2.	21.0	17.50	0.83	1312.50	62.50	5.25	0.25	5250.00	250.00	6562.50	312.50
3.	24.0	24.00	1.00	1800.00	75.00	10.00	0.42	10000.00	416.67	11800.00	491.67
4.	3.5	15.00	4.29	1500.00	428.57	0.00	0.00	0.00	0.00	1500.00	428.57
5.	3.5	13.00	3.71	1300.00	371.43	0.88	0.25	875.00	250.00	2175.00	621.43
6.	16.0	34.00	2.13	2640.00	165.00	4.00	0.25	3600.00	225.00	6240.00	390.00
7.	1.5	6.00	4.00	480.00	320.00	0.38	0.25	300.00	200.00	780.00	520.00
8.	2.5	2.00	0.80	150.00	60.00	1.00	0.40	1000.00	400.00	1150.00	460.00
9.	3.0	15.75	5.25	1181.25	393.75	0.00	0.00	0.00	0.00	1181.25	393.75
10.	4.0	11.00	2.75	825.00	206.25	1.00	0.25	1000.00	250.00	1825.00	456.25
<b>AVG.</b>		19.13	2.56	1516.38	214.46	3.85	0.23	3802.50	224.17	5318.88	438.63
<b>S.D.</b>		14.12	1.59	1049.18	143.49	5.04	0.13	5047.65	131.05	5924.34	89.45

## Chillies & Cotton

**Table C-11: Surplus of Revenue Over Total Variable Cost**

S. No.	Acres	Variable input cost per acre							Total var. cost per acre	TR1/Acre	TR2/Acre	TR/Acre	Surplus per acre	% surplus to TR
		Labour	Mech. energy	Manure	Seed (Ch)	Seed (Co.)	Fertilizers	Pesticides						
1	64.0	583.1	312.1	160.2	75.0	16.0	250.0	0.0	1396.4	2734.4	1500.0	4234.4	2838.0	67.02
2	21.0	861.4	312.5	450.0	30.0	14.0	508.5	0.0	2176.5	1666.7	5142.9	6809.5	4633.1	68.04
3	24.0	1535.4	491.7	37.5	24.0	14.0	270.0	54.2	2426.8	6562.5	6000.0	12562.5	10135.7	80.68
4	3.5	659.3	428.6	71.4	28.6	18.3	325.7	0.0	1531.9	3657.1	2742.9	6400.0	4868.1	76.06
5	3.5	787.9	621.4	400.0	28.6	30.0	467.1	0.0	2335.0	3000.0	3000.0	6000.0	3665.0	61.08
6	16.0	257.2	390.0	75.0	30.0	18.0	243.8	0.0	1013.9	1312.5	180.0	1492.5	478.6	32.06
7	1.5	546.7	520.0	200.0	30.0	32.0	586.7	0.0	1915.3	3000.0	1000.0	4000.0	2084.7	52.12
8	2.5	571.0	460.0	150.0	28.0	12.0	292.0	0.0	1513.0	5600.0	2240.0	7840.0	6327.0	80.70
9	3.0	444.2	393.8	100.0	25.0	35.0	316.7	0.0	1314.6	3500.0	640.0	4140.0	2825.4	68.25
10	4.0	526.3	456.3	375.0	33.3	32.0	475.0	0.0	1897.8	3500.0	400.0	3900.0	2002.2	51.34
Avg.	14.30	677.24	438.63	201.91	33.25	22.13	373.55	5.42	1752.11	3453.32	2284.57	5737.89	3985.78	63.74
S.D.	18.39	327.68	89.45	143.44	14.14	8.52	117.35		446.25	1517.37	1888.10	2861.55	2590.70	14.41
C.V.	1.29	0.48	0.20	0.71	0.43	0.39	0.31		0.25	0.44	0.83	0.50	0.65	0.23