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Tenancy in Semi-Arid Tropical Villages of South India: Determinants and Effects on Cropping Patterns and Input Use

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PREFACE AND ACKNOWLEDGEMENTS

This paper summarizes work done as part of a Ph.D. thesis titled 'Contractual Arrangements in Agriculture: Some Theory and Empirical Evidence', which was submitted to the Indian Statistical Institute, Calcutta in September 1980.

I gratefully acknowledge my debt to the ICRISAT Economics Program and especially to Drs. Binswanger and Ryan for allowing me access to the Village Level Study (VLS) data collected by the ICRISAT. I am also grateful to the other members of the Program, particularly Messrs. Bhaskar Rao, Krishna Gopal, Valasaiah and David for their untiring efforts in providing data in the shortest possible time. Mr. Rabindranath Mukhopadhya and Dr. Dipankar Coondo at ISI provided valuable assistance in the computational aspects.

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It is my pleasure and privilege to record my debt to my thesis supervisor, Prof. T.N. Srinivasan. Whatever worthwhile emerges from this study, I owe to his supervision.

Needless to say, I am alone responsible for whatever errors there are, in analysis or in interpretation.

INTRODUCTION

In this paper we will utilize household and plot-level data to illustrate the importance of land leasing for agricultural households. We will be concerned mainly with three aspects of tenancy:

1. The importance of the household's resource endowments in determining the extent of land it will lease-in or lease-out.

2. Comparisons of the cropping pattern on leased-in land and self-cultivated land to see whether the cultivator has a different cropping pattern preference for these two types of landholding. Specifically, we look for differences in the tenants and owner-operator's preferences for risky cropping patterns.

3. The input use pattern on rented and self-cultivated land. In particular, we will examine whether sharecroppers use less non-land inputs per hectare of cultivated land compared to owner-operators.

For our analysis we use data obtained from the VLS initiated by the ICRISAT Economics Program in May 1975. A supplementary tenancy schedule was later canvassed by N.S. Jodha to obtain more detailed qualitative information on tenancy. This schedule recorded information on various aspects of tenancy from different landlord-tenant pairs. Information such as reasons for leasing cost sharing and crop sharing patterns, nature of linkages in the land and credit market etc., was obtained. The results of this survey have been reported by Jodha (1979). Our analysis of tenancy in the same villages differs in scope and method from Jodha's analysis and as such the two papers complement each other.

The data pertains to six villages, all located in the semi-arid tropics (SAT) of south India. The selected villages were Aurepalle and Dokur in the Mahbubnagar district of Andhra Pradesh, Shirapur and Kalman in Sholapur district of Maharashtra, and Kinkheda and Kanzara in the Akola district of Maharashtra. In Table 1 we present some important village characteristics.

Table 1. Important characteristics of sample villages, 1975-76.

	VILLAGE					
	Aurepalle	Dokur	Shirapur	Kalman	Kanzara	Kinkheda
Landless households (%)	28	13	24	24	33	41
Landowners who leased-out all land (%)	1	7	15	26	3	1
Land operators (%)	71	98	62	50	64	58
Irrigable area as percentage of total cropped area	12	32	8	9	4	1

From each of the sample villages a sample of forty households was selected to ensure representation of all categories of households - labor households, small farmer households, medium farmer households, and large farmer households.[1] For each of the sample households, information on various aspects of traditional farming practices was elicited. The data collected include:

i) The resource endowments of sample households. Some of the resources for which data are recorded are land, family labor, livestock, farm machinery, and irrigation equipment.

ii) Cultivation details, including input-output data for each crop or crop mixture on each of the cultivated plots.

iii) A separate schedule records the family's utilization of its owned labor resources along with estimates of the extent of unemployment of these resources and the wage rates.

iv) In other schedules all transactions undertaken by the households are recorded. These include details of income, expenditure, savings, debts, and credit.

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1. For details of sampling procedure and the methodology adopted in the VLS, see Jodha _et al_. (1977).

TENANCY AND RESOURCE ENDOWMENT

In this section we utilize a part of the information collected in the survey to determine to what extent a household's land leasing decision is influenced by its resource endowment. This is important when the market for some of these resources is either non-existent or functions imperfectly. Imperfection in markets, notably those of land, wage-labor, and credit is a commonly observed characteristic of less developed agriculture. For example, credit is not always available on equal terms to the richer and poorer households because poorer households do not possess acceptable collateral. Imperfections in the land and labor markets are manifested in several ways, some of which reflect the monopoly power that a landowner possesses in such economics.[2] There is, in addition, the phenomenon of interlocked markets, in the sense that the same individuals transact with each other in two or more markets simultaneously and this linking of trade in different commodities and services is found to be essential because delinking is either infeasible or too costly.[3]

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2. For descriptions of market imperfections, see for example Bardhan and Rudra (1978), Bharadwaj, K. (1974), Binswanger and Doherty et al. (1980), Jodha (1979) and, Ryan and Rathore (1978).

3. In the context of ICRISAT villages, Jodha (1979) and Binswanger et al. (1980) have documented various types of interlinkages. For example, in some villages land leasing and credit transactions were interlinked; in others there were interlinkages between credit transactions and the market for permanent servants. More complex linkages involving land, credit, and marketing transactions were also observed. The implications of interlinked transactions, its consequences for tenancy, its exploitative character etc. have been a matter of debate. See for example, Bhaduri (1973), Newbery (1975), Srinivasan (1979), Pant (1980).

While there is a market for wage-labor it is sometimes the case that social customs and/or legislations prevent some members of a rural household from entering the labor market. For example, children below a certain age cannot offer themselves for wage employment. Sometimes women are also not permitted, particularly for some agricultural operations. Similarly, caste or other conventions may act as barriers to entry in the labor force. Higher caste households would be reluctant to allow their family members to work as hired laborers, especially of the hirer is from a lower caste. But while these members cannot work outside as wage laborers, they can of course work on owned or leased land. Thus women and children who cannot offer themselves for wage employment may be usefully employed on self-cultivated land. They can assist in operations not involving much physical effort. Similarly, members of higher caste households who are reluctant to work as hired wage laborers can be utilized in cultivation of leased or owned land.

The non-existence of a market for bullock hire services (as distinct from the market for the sale and purchase of bullocks) has been the focus of attention in the recent literature on tenancy in India. A number of reasons have been suggested for the absence of such a market and these have been lucidly summarised in Bliss and Stern (1981). Here, we only mention some possible reasons.

First, if the purpose of hiring bullocks is only to facilitate households in balancing their endowment of draft labor with land under cultivation, when the land lease market functions smoothly this is not the only way of doing so. By leasing-in or leasing-out land the household can adjust the land area cultivated by it to its endowment of draft labor, rather than the other way around. Moreover, there are reasons why specialised bullock service suppliers are not as common as one would expect. On disadvantage arises from the fact that since bullocks are utilized for certain operations only (largely for prolonging but also to some extent in irrigation, transportation and threshing), income from bullock hiring would be confined to only those periods in which such operations are undertaken. Given the seasonal nature of production in agriculture, this would be confined to particular periods in a year (say, before rainy season and post rainy season sowing, if bullocks are used primarily for prolonging). Thus, for the rest of the year the bullocks (and their owner) would be underemployed. This problem is more acute in regions where there is only one cropping season. Even within the plowing period it may not be possible to work on more than a few fields, given the fact that the seasonal nature of production necessitates plowing at more or less the same time on all farms. Hiring of bullocks may also be discouraged due to caste factors. If bullocks are to be worked by their owner, he may not have any incentive to work efficiently on the hirer's land. To ensure efficient use of the hired bullocks, the hirer may therefore need to supervise work. This may not be possible if the hirer belongs to a lower caste since the higher caste bullock owner would be reluctant to work beside a lower caste hirer.

Where market function imperfectly (as in the case of wage labor) or do not function at all (as in the case of draft animal services), then a household's ability to cultivate land is partly determined by its ownership of essential inputs (like human labor, draft animal labor or managerial ability). Thuse a household that owns land but has insufficient bullock labor to cultivate all of it may lease-out a part of its land, since in the absence of a market for bullock hiring it cannot hire in additional draft animal services. Conversely a household with excess bullocks may wish to lease-in more land in order to utilize its endowment of bullock labor more fully, since it is unable to hire out its surplus draft animal labor.

In the same way, if for some members in the household there are no employment opportunities except working on owned or leased land, that household may lease-in land to ensure fuller utilization of its family labor. Thus one possible hypothesis is: Ceteris paribus, households with a relatively greater (lesser) endowment of labor (human or bullock or both) or some other imperfectly marketed input, will lease in relatively more (less) land. Clearly, this hypothesis is likely to be valid when the market for one of the resources is either not functioning or is functioning improperly.[4]

The VLS Household Member Schedule (VLS-C) gives, for each sample household, details of its family size, age-sex composition, educational qualifications and main occupation of every member in the household. Also included are similar details regarding permanent servants attached to the household. Thus this schedule provides an estimate of the total labor available within the household. In estimating the household's endowment of human labor we need to decide whether permanent servants should be included or not. In so far as the decision to hire permanent/ attached servants is taken after the household decides on the extent of land it will cultivate, clearly, for our purposes, permanent servants should not be included in estimating the labor available within the household. However, it is possible that a permanent servant is available to the household prior to its decision to lease-in (out) land. For example, in return for credit a laborer may agree to work on the cultivator's land and this transaction may have been undertaken in an earlier period. In such cases the cultivator may lease-in land taking

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4. In a somewhat different context Ryan and Rathore (1978) observed that while there was a large variability in the resource endowment ratios across farms, village labor and credit markets did function in such a way as to make the 'operational' factor ratios much more equal than the initial endowment ratios.

account of the extra labor available to it.[5] Recognizing this possibility we have done our analysis first by excluding permanent servants and later by including them in estimating family size and the labor available within the household. However, we find little qualitative difference in the conclusions and we will therefore report the results for the case where permanent servants have been excluded.[6]

The VLS-C schedule also has a degree of disability code for every member of the household. This indicates whether that member is suffering from any permanent disability or disease and is unable to work. Disability due to old age is also included. This information can be utilized to provide an estimate of the number of 'dependents' in the family. The other possible estimate of the number of dependents is the number of old (that is, those above sixty five years of age) males and females plus the number of children below the age of fourteen years. But again, we find that the choice of our definition does not alter our conclusions and we therefore present our analysis for the case where the number of dependents equals the number of old males and females plus

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5. This depends on whether lease contracts are short-term and renewable or long-term. If it is long-term, the household cannot easily take advantage of a random short-term availability of labor.

6. For details of labor market relations and the nature of contracts in the sample villages see Binswanger et al. (1980).

the number of children below fourteen years of age. By 'workers' we refer to all other family members, that is, the number of males and females between the ages of fourteen and sixty five years. Thus the VLS-C schedule provides the following estimates:

a) the total availability of labor in the household, given by the number of 'workers',

b) the consumption requirements of the household, as measured by the total family size,

c) the dependent-worker ratio in the household.

The VLS Plot and Crop Rotation Schedule (VLS-D) provides for each sample household the following details: For each plot cultivated by the household it records the area of that plot, its ownership status (that is, whether it is owner-operated, leased-in, or leased-out and on what type of contract etc.) and the command area under irrigation on that plot.[7] From this we can obtain estimates of (a) the extent of cultivable land owned by each household. This is obtained by adding the cultivable areas of all plots owned and operated by the household, plus the areas of all plots leased-out by the household; (b) the extent of land leased-in or leased-out by the household.

7. This is the area which under normal circumstances could receive irrigation.

The VLS Animal Inventory Schedule (VLS-E) provides an inventory of the total livestock owned by the household, both in numbers and in value terms. This includes items like cattle, buffaloes, cows, goats, and sheep. We record the total value of bullocks owned by each household and use this as a proxy for the availability of draft power in the household.[8]

Our analysis is based on the combined data for 1975-76 and 1976-77. Following the preceding discussion, we wish to set up a regression model which will illustrate whether the extent of land leasing serves to adjust the household's endowment of labor (human or draft animal) to the land area cultivated by it. Our regression model attempts to explain variations in net area leased-in across households in terms of explanatory variables such as the extent of land ownership, the number of workers, extent of ownership of draft animals (bullocks) and the dependent worker composition in sample households.[9]

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8. It is possible that bullocks are bought and sold within an agricultural year, especially by small farmers. Since we are dealing with the inventory of bullocks at the end of each year, it may be that we are not picking up the effect of within-season purchases of bullock power.

9. We tried other variants of our basic regression model. For example, in one variant we regressed the net leased-in area per worker on the land ownership per worker, per worker availability of bullocks, per worker availability of farm machinery and the dependent worker ratio. The results of all exercises were in broad conformity with the one presented here in Table 2.

We would expect the regression coefficient for the extent of land ownership to be negative. Households owning more alnd (in relation to the labor resources available to it) will lease in less land. Conversely, we would expect the coefficient for the endowment of human labor and/or bullock labor to be positive. That is, households owning more labor resources (in relation to their ownership of land) would lease-in more land so as to utilize its labor resources more fully, in situations where the labor market functions imperfectly.

We have included the dependent worker ratio as an explanatory variable to probe whether the age composition of the household has any bearing on land leasing. (As we mentioned, this variable also reflects the composition of a household in terms of the more active and less active members.) If, as we argued, dependents are not wage employable but can nevertheless be employed on the household's operational holding, at least in some operations, then we may expect its regression coefficient to be positive. Households with relatively more dependents would lease-in more land so as to utilize its dependent labor more fully. It is however equally plausible that the regression coefficient may be negative. If the dependents are largely infants and/or disabled then some proportion of the working member force in the household may be diverted to the care of such dependents. Thus in such cases not all adult males and females may be available for work on land. The higher the number of such dependents in a family, the less is likely to be the number of members available for work on owned land and therefore leasing of land will be less.

The Ordinary Least Square regression estimates are presented in Table 2.

It is clear from Table 2 that:

1. The coefficient on land ownership is negative and significant in all villages. In other words, households owning more land will, ceteris paribus, lease-in relatively less land. Thus the hypothesis that land leasing brings into closer alignment the household's endowment of land and labor resources, is not rejected.

2. The coefficient on value of bullocks owned is positive and significant in all villages, which lends support to the hypothesis that we are dealing with an imperfectly functioning market for bullock hire services; the extent of availability of bullocks within a household is an important determinant of the extent of land leased-in (out) by it. We observe, however that the regression coefficient is not uniform across villages. In fact, while an extra bullock pair valued at Rs. 2000 would permit a household in Kalman to cultivate an additional four hectares of land, in the Mahbubnagar villages a similar pair of bullocks would allow only an additional one hectare of land to be cultivated. While there are inter-village differences, the coefficients for Sholapur (Kalman and Shirapur) and Akola (Kinkheda

Table 2. The effect of resource endowment of tenancy: Estimated coefficients of the regression equation explaining net leased-in area per household (in hectares)

District/ village	Independent variables				$\bar{R}^2$	No. of obser- vations
	Area of land owned (ha)	Value of bullocks owned (Rs.)	Number of workers	Dependent/ worker ratio		
MAHBUBNAGAR						
Aurepalle	-0.2^{**}	$3.6\times10^{-4**}$	$20.0\times10^{-2**}$	-5.3×10^{-2}	0.62	59
	(-9.0)	(2.5)	(2.2)	(-0.3)		
Dokur	-0.3^{**}	$6.9\times10^{-4**}$	7.3×10^{-2}	23.9×10^{-2}	0.04	76
	(-2.4)	(2.5)	(0.5)	(0.8)		
Aurepalle + Dokur	-0.2^{**}	$4.0\times10^{-4**}$	9.3×10^{-2}	5.7×10^{-2}	0.23	135
	(-6.5)	(3.0)	(1.0)	(0.3)		
SHOLAPUR						
Kalman	-0.5^{**}	$21.5\times10^{-4**}$	-35.2×10^{-2}	$-115.3\times10^{-2**}$	0.28	65
	(-3.9)[a]	(5.0)	(-1.2)	(-2.0)		
Shirapur	-0.2	$6.5\times10^{-4*}$	$39.7\times10^{-2*}$	-18.2×10^{-2}	0.16	64
	(-1.4)	(1.7)	(1.7)	(-0.4)		
Kalman + Shirapur	-0.3^{**}	$15.0\times10^{-4**}$	-7.3×10^{-2}	$-67.6\times10^{-2*}$	0.20	129
	(-3.2)	(5.3)	(-0.4)	(-1.8)		
AKOLA						
Kinkheda	-0.2^{**}	$9.3\times10^{-4**}$	6.5×10^{-2}	-13.4×10^{-2}	0.10	61
	(-3.2)	(2.7)	(0.5)	(-0.6)		
Kanzara	-0.2^{*}	$13.0\times10^{-4**}$	-4.1×10^{-2}	-24.3×10^{-2}	0.10	60
	(-1.8)	(3.0)	(-0.2)	(-0.5)		
Kinkheda + Kanzara	-0.2^{**}	$12.6\times10^{-4**}$	-3.0×10^{-2}	-17.4×10^{-2}	0.13	121
	(-3.7)	(4.6)	(-0.2)	(-0.7)		
All villages	-0.2^{**}	$10.5\times10^{-4**}$	-2.0×10^{-2}	-19.8×10^{-2}	0.15	385
	(-6.7)	(8.0)	(-0.3)	(-1.2)		

a The numbers in brackets refer to computed t values

** denotes t is significant at 5% level

* denotes t is significant at 10% level

and Kanzara) villages are similar. For both these regions, an additional pair of bullocks valued at Rs. 2000 permits cultivation of an additional area of about three hectares of land, while for all six villages an additional bullock pair permits cultivation of an additional two hectares of land.[10]

3. Contrary to the uniformly positive influence of the extent of ownership of bullocks on land leasing, the number of workers in a household has not significant bearing on its leasing behavior. Shirapur, Kinkheda, Aurepalle, and Dokur households with a larger number of workers, do lease in more land, but this is not the case in Kalman and Kanzara. In only Aurepalle and Shirapur is the effect statistically significant.

4. In all villages except Dokur, households with relatively more dependents lease in relatively less land. While the regression coefficient is not statistically significant in most cases, the analysis does not support the hypothesis that a household may be motivated to lease-in land in order to fully utilize its dependent family labor.

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10. Bliss and Stern (1981) estimated that in Palanpur a household with an additional pair of bullocks (of value Rs. 2000) would wish to cultivate about 2.4 hectares of additional land.

This result, together with (3) suggests that in these six villages, imperfections in the wage-labor market are not sufficiently important to influence a household's leasing behavior. However, the imperfect functioning of the market for bullock hire services does play a crucial role in determining the extent of land a household leases in or leases out.

Some of these results agree with Jodha's (1979) findings. Jodha canvassed information on the reasons for tenancy, and one of the reasons mentioned was resource adjustment. For all those households that gave resource adjustment as the motivation for land leasing, Jodha compared the land availability per worker (per bullock) for the landowning household and the tenant household before and after the tenancy transaction. He found that while land leasing did tend to reduce the difference between land availability per bullock between the landowner and the tenant household, the differences were not narrowed in the case of the land/worker ratio. In other words, while the availability of bullocks in a household was found to influence the extent of land leased-in (leased-out) by it, availability of family labor did not appear to be a constraint on leasing.

We should mention one limitation of our analysis. We assume that the regression equation we estimate is the same regardless of whether the household leases-in or leases-out land. However, it is possible that imperfections in markets and institutions may lead to an asymmetry (both in respect of opportunities and responses) between those on the two sides of the tenancy transaction. In such circumstances it would be more appropriate to consider the behavior of lessors and lessees separately. However, given the fact that in our sample the number of households in each group is not very large, we did not separate the two groups of households.[11]

TENANCY AND CROPPING PATTERN

In this section we ask the question whether there are any reasons for a tenant (and in particular a sharecropper) to choose a cropping pattern different from one that would be chosen by an owner-operator. In other words does the form of tenancy contract influence the cultivator's preference among crops? Consider the same individual cultivating the same land in three alternative situations:

i) He has leased-in land under a share contract. Assume the rental share is the same for all crops and the tenant chooses the amount of land to lease-in and the cropping pattern on leased-in land.

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11. Our specifications concentrate exclusively on the resource endowment of the household and its influence on leasing. We are thereby ignoring other factors which may be equally important in determining the extent of land leased-in by the household. This is of course reflected in the low R^2 in our regressions. See Jodha (1979) for a discussion of other motivations for land leasing in the sample villages.

ii) He leases-in the same land but under a fixed rent contract. The rent is specified in terms of the crop sown by the tenant and he chooses the cropping pattern on leased-in land.

iii) Finally, suppose the tenant buys the same land so that he becomes an owner-operator. He then decides on the cropping pattern on this land.

We want to know whether the cropping pattern choices of the same cultivator will be different in the three situations and if so, in what way and why.

In the literature on this subject two competing hypotheses have been suggested. The first hypotheses states that since a share contract allows the tenant-cultivator to share risks in production with the landowner, production risks for the cultivator in a share contract are likely to be less than under a fixed rent contract or in self-cultivation. Suppose cropping pattern preferences are based on expected returns and risks. Then, since for any cropping pattern a share tenant faces less risks he may be induced to prefer a relatively more risky cropping pattern provided it has a larger expected return. Thus, in the context of production uncertainty, the hypothesis for test is: under sharecropping a cultivator adopts a relatively more risky cropping pattern with higher expected returns as compared to the cropping pattern preference of the same cultivator operating his own land or cultivating fixed-rented land.

Testing this hypothesis in its exact form would be very difficult, however. At the very least it would require us to consider only those cultivating households who operate both owned and leased-in land of the same quality. For all such cultivators we would then compare the cropping pattern on the owner-operated and leased-in plots. Even this would not be strictly correct, however. For it is quite possible that the choice of crops grown on share rented land may be influenced by the crops grown on the owner-operated plots by the owner-tenant. In other words, cropping pattern decisions on the share rented plots may not be completely independent of the cropping decisions on owned land.

Even if we ignore this difficulty, it is clear that in practice it may not be possible to confine our test to only those cultivators owning as well as leasing-in land. Quite often there may be just too few such households in the sample. In such cases the only alternative may be to compare cropping patterns on share rented and owner-operated land, regardless of whether the owner-operated land and the tenanted land are cultivated by the same cultivator or not. Interpersonal differences may then vitiate the hypothesis. For example, if fixed-rent tenants and/or owner-operators are more wealthy than share tenants and if risk aversion decreases with wealth, cropping pattern differences predicted by the hypothesis may not be observed. Similarly, differences in irrigation facilities available to the richer owner-operators and the poorer tenants provide an advantage to the former and permits them to adopt risky cropping patterns with higher expected returns. These qualifications need to be kept in mind in interpreting the results.

The second hypothesis has been suggested by C.H. Rao (1971). He argued that under sharecropping the tenant does not receive the entire reward for entrepreneurship and decision making, while in a fixed-rent contract he does. Therefore, in situations where there is greater scope for entrepreneurial decision-making, a cultivator would prefer to lease-in land on a fixed-rent contract. If the scope for decision-making and entrepreneurship increases as production becomes more risky, then Rao predicts fixed-rent tenancy will be more prevalent in regions characterized by greater uncertainty, while share cropping will be more widespread in relatively stable environments. In terms of cropping preferences this argument suggests that fixed-rent tenants would prefer a more risky cropping pattern (with higher expected returns) than sharecroppers.

There are, however a number of problems with this hypothesis. First, it completely ignores the risk-sharing advantage in sharecropping. While a sharecropper shares the rewards of his entrepreneurship with his landowner, he also passes on a part of the production risks to the landowner. Under a fixed-rent contract, the tenant gets the entire reward for his entrepreneurship, but he faces all the risks himself. Thus, in the absence of further information it is not clear why a cultivator would prefer fixed rent tenancy despite the risk spreading advantage of sharecropping. There is another problem, in that Rao ignores the quantitative dimensions involved in the choice of contracts. To take a simple hypothetical illustration, consider two situations A and B and consider a tenant's choice between sharecropping and fixed-rent tenancy in A and B. Suppose A represents the more uncertain environment in the sense that, for given inputs, output is more sensitive to either weather fluctuations or to entrepreneurship (say, to the timing of a particular operation in cultivation). For the same level of inputs used, suppose output produced per hectare in A and B are as given below:

	Output in kgs in A	Output in kgs in B
State of world (SOW) 1	10	6
State of world (SOW) 2	0	6

Clearly, A is a relatively more uncertain environment and Rao's hypothesis would suggest that the tenant should always prefer fixed-rent tenancy (sharecropping) to sharecropping (fixed-rent tenancy) in situation A(B). But suppose the rental share in the share contract is half and the rent per hectare in the fixed-rent contract is 5 kg.

Then the income of the tenant in situations A and B is given below:

	Income of tenant			
	Situation A		Situation B	
	SOW 1	SOW 2	SOW 1	SOW 2
Under sharecropping	5	0	3	3
Under fixed-rent	5	-5	1	1

Clearly, the tenant prefers sharecropping in A as well as in B, contrary to what is predicted by Rao.

Most of the empirical studies on tenancy and cropping rely on data collected for other purposes and as such, information on tenancy and cropping pattern are often published at a very aggregated level. The most disaggregated level data on tenancy and cropping available from Farm Management Surveys (FMS) can be obtained from the volume II tables which give, for each operational holding in the sample, the area under each crop as well as the share of owned land and leased-in land on that holding. One difficulty in using these data for our purposes is that quite often the sample contains too few holdings with leased-in land. Moreover, the FMS does not give the cropping pattern on the owned and rented parts of the holding separately. While it may be possible to group holdings on the basis of the extent of land leased-in on these holdings and then study cropping differences across these groups (and we will ourselves be doing this later), such aggregation may well distort the true relationship. Ideally, one would want to have the cropping pattern on tenanted and owner-operated land separately. This is possible from the plot-level tenancy and cropping data available in the VLS-D schedule. For each plot in the operational holding, this schedule gives the tenure status and the cropping pattern on that plot. If there are no systematic relationships between tenancy and other factors (like irrigation), it may be possible to relate cropping differences to differences in tenure.

Our analysis is based on the combined data for two years, 1975-76 and 1976-77. In order to relate cropping differences on tenanted and owner-operated plots to the riskiness of alternative cropping choices, we need to develop a measure of riskiness of the cropping pattern.[12] In earlier work, Jodha (1977) distinguished two crop categories drought-resistant and drought-sensitive crops. Drought-resistant crops included pearl millet (bajra), sorghum (jowar), finger millet (ragi), other minor millets, pigeonpea (redgram), chickpea (bengal gram), black gram, green gram, castor, sunflower, and safflower. Drought-sensitive crops included paddy, wheat, maize, groundnut, sesamum, mustard, linseed, cotton, sugarcane, and vegetables.

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12. Binswanger et al. (1979) found that yield variability was much more important than price variability in conditioning income variability in SAT regions of India. Therefore, our analysis focuses on yield risk.

We used Jodha's classification to compare the allocation of cropped land on owner-operated and tenanted land to drought-sensitive and drought-resistant crops. We also performed two-way tabular analysis on the extent of intercropping and sole cropping by form of tenancy. Intercropping appears to be a more stable spatial arrangement than sole-cropping (Jodha 1977); thus, we expected sharecroppers to have a lower incidence of intercropping.

Our comparison of cropping pattern on tenanted and owner-operated plots, revealed the following differences:

1. Owner-operators show a greater preference for more risky crops, particularly in the kharif season. Sharecroppers do not appear to adopt a more risky cropping strategy.

2. More labor intensive and higher-value crops, such as wheat, paddy, groundnut, cotton, and sugarcane, are more common on owner-operated land. High-yielding varieties are also more common on owner-operated land.[13]

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13. More information on these tabular comparisons can be found in my Ph.D. dissertation, "Contractual Arrangements in Agriculture: Some Theory and Empirical Evidence", submitted to the Indian Statistical Institute, Calcutta, September 1980. Since Jodha's original analysis in these villages V.S. Doherty, Principal Anthropologist at ICRISAT, has found that the classification into owner-operator, fixed-rent contracts, and sharecropping contracts is an oversimplification of the complexity of land tenancy arrangements in these villages. Hence the detailed analysis based on Jodha's classification is not presented here.

However, since we cannot say whether these differences are statistically significant or not, we only suggest that our data do not reveal that tenants adopt a more risky cropping strategy compared to owner-operators. Moreover, in our comparison we do not take account of irrigation differences. It is therefore possible that a household may devote a larger area to drought sensitive crops like paddy, but since its area is better irrigated, this decision may not necessarily reveal a greater inclination to take risks. Thus a larger area devoted to drought-sensitive crops does not necessarily imply that a household is adopting a more risky cropping strategy. To overcome this problem we could eliminate all irrigated plots from our analysis and discuss cropping differences on unirrigated plots only. However, since this reduces our sample size significantly in some of the villages we do not do this.

Instead, we try to explain the preference of a cultivating household to grow drought-sensitive crops in terms of variables like (i) the extent of tenancy on the household's operational holding, (ii) the extent of irrigation on the operational holding, and (iii) the size and composition of the cultivating household. In Table 3 we present the estimated coefficients of our regression model.

Table 3. The effect of tenancy and resource endowment on cropping pattern: Estimated coefficients of the regression equation explaining percent area planted to drought sensitive crops in kharif.

District/ village	Independent variables: Leased-in area as % of total operated area	Command area under irrigation as % of total operated area	Dependent/ worker ratio	Area operated per worker (ha)	$\bar{R}^2$	No. of observations
MAHBUBNAGAR						
Aurepalle	-0.09 (-1.1)[a]	0.11 (0.8)	0.46 (0.2)	2.0** (2.1)	0.14	57
Dokur	-0.01 (-0.5)	0.48** (4.0)	-6.9 (-1.1)	7.3 (1.2)	0.25	65
Aurepalle + Dokur	0.01 (0.1)	0.83** (12.2)	0.34 (0.1)	1.0 (0.6)	0.60	122
SHOLAPUR						
Kalman	-0.19 (-1.4)	0.14 (0.6)	-4.34 (-0.9)	2.8 (1.2)	0.07	55
Shirapur	-0.03 (-0.2)	0.87** (3.8)	1.13 (0.1)	-3.0 (-0.7)	0.41	48
Kalman + Shirapur	-0.05 (-0.5)	0.70** (4.6)	-0.19 (-0.05)	-0.8 (-0.4)	0.21	103
AKOLA						
Kinkheda	-0.08 (-0.4)	0.40 (0.6)	2.68 (0.6)	0.6 (0.3)	0.02	60
Kanzara	-0.11 (-0.4)	-0.31* (-1.8)	0.18 (0.03)	-0.2 (-0.2)	0.07	50
Kinkheda + Kanzara	-0.16 (-1.0)	-0.11 (-0.5)	3.47 (1.1)	0 (0)	0.02	110
All villages	-0.2** (-2.6)	0.46** (7.7)	-1.64 (-0.7)	-0.4 (-0.3)	0.21	335

a the numbers in parantheses refer to computed t-values
** denotes t is significant at 5% level
* denotes t is significant at 10% level

Our tabular analysis would appear to suggest that the allocation to drought-sensitive crops would be higher on holdings with relatively less of its area leased-in. As is evident from Table 3, this is indeed the case. Thus the adoption of drought-sensitive crops is higher on owner-operated land compared to tenanted land. However, in no village is this difference significant. Thus we can only assert that our data does not support the hypothesis that sharecroppers would devote a greater proportion of their cropped land to the more risky crops compared to owner-operators.

We would expect irrigation differences to influence the extent of allocation of land drought-sensitive crops. On holdings which have more and/or better irrigation facilities, it is likely that a greater area will be devoted to drought-sensitive crops since the risks in cropping are reduced with irrigation. This is indeed the case, as revealed in Table 3.

The dependent/worker ratio and the area operated per worker measure the influence of the size and composition of the cultivating household on the allocation of cropped land to drought-sensitive crops which are, generally, more labor intensive. We see from Table 3 that these variables do not have any significant influence on the allocation to drought-sensitive crops.[14]

Thus, to summarize, our regression analysis confirms our earlier finding that tenancy does not influence significantly the allocation of cropped land to drought-sensitive or drought-resistant crops and, moreover, irrigation appears to be the only variable which has a positive impact on the allocation of land to drought-sensitive crops.

TENANCY AND INPUT USE

In this section we report our results relating to the use of inputs on sharecropped and owner-operated land. It has been argued that since sharecroppers receive only a fraction of the marginal product of the input they apply on rented land, they would not utilize as much input as would an owner-operator. As against this hypothesis,

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14. In discussing the role of household resource endowments on land leasing, we had discussed the hypothesis that the extent of land leased-in (out) by a household would depend on the household's family size and composition. However, our analysis of data did not support such a hypothesis in the ICRISAT villages. We are therefore not committing a specification error by including these three variables as independent variables in the regression equation in Table 3.

Cheung (1969) and others have argued that if the landowner is 'powerful' enough, he can specify the input intensity on leased-out land and to the extent this is feasible and enforceable, there will be no inefficiency. Even in situations where the input intensities cannot be unilaterally fixed by the landowner (of if this is unenforceable anyway), there are other ways (for example, cost-sharing) by which the landowner can induce the sharecropper to use inputs more intensively.

Our analysis will be based on the 1975-76 data for the two villages, Kalman and Shirapur. We have chosen only two of the six sample villages because sharecropping is relatively more widespread in these villages. In the other villages the number of farms which are sharecropped and for which input-output data are recorded are too few for meaningful inferences to be drawn. We now describe our data briefly.

As in the earlier sections, we utilize the VLS Plot and Crop Rotation Schedule (VLS-D), which gives for each plot cultivated by the sample household its area, ownership status, as well as the command area under irrigation. The VLS Cultivation Schedule (VLS-H) records, for each of the cultivated plots listed in VLS-D, the details of inputs used in each season. The schedule records the nature of every agricultural operation, its timing and the quantities of different inputs used during any operation.

The data have a number of interesting features. First, input-output data for each plot in the sample is recorded separately. Since in the investigations a plot was classified as either share-rented or owner-operated (and not share rented and owner-operated in parts), by recording input and output data for each plot separately we can obtain information on the utilization of inputs on sharecropped and owner-operated land. Some of the earlier studies relied on farm level data.[15] Since they presumably did not have input-output data on the leased-in and owned parts of the holding separately, they could relate input use to tenancy only indirectly by regressing the total input used per hectare on the percentage area leased-in on the operational holding. Our data permit us to directly test for input use differences at the plot level.

Another feature of the input use data is that a distinction has been made between hired and owned inputs whenever this was possible. Thus in this case of human labor, family and hired labor inputs are recorded separately. This distinction has also been made between hired and owned bullock labor used. A third feature of the data is that the input of adult male labor, adult female labor and child labor is recorded separately. This permits us to test whether sharecroppers

15. See for example Chakravarty and Rudra (1973) and Dwivedi and Rudra (1973).

or owner-operators reveal any preference for male versus female labor. We will now mention some of the limitations in our use of the data.

1) In our analysis we have added together the number of hours worked by adult males, adult females, and children to arrive at an estimate of total labor hours used for any operation. A suitable weighted addition, giving the number of man-equivalent labor hours worked during an operation would have been more appropriate. However, since in our sample the incidence of child labor use is rather limited (only about 10% of the total cultivated plots in Kalman and Shirapur used some child labor), we do not expect this to make any difference to our conclusions.

We must also point out that the labor hours utilized in any operation includes the time taken in reaching the place of work. However, since we cannot think of any reason for this component to be systematically higher or lower on tenant land, this is not likely to affect our comparisons.

2) We record bullock labor input in terms of the number of hours worked by a bullock-pair. We are, therefore, ignoring differences in the quality of bullocks. Also, just as in the case of human labor, the number of hours taken in going to the plots is included in the recorded data.

3) Input of different kinds of fertilizers and manure used are recorded separately in terms of kilograms and quintals, respectively. We can therefore test for differences in the use of each type of fertilizer and manure.

4) The quantity (in kilograms) of seed used on each plot is recorded. For some crops like sugarcane, chillies, and onions, the number of seedlings is recorded rather than the quantity of seed. In comparing seed inputs therefore, we will consider only those plots where the seeds are recorded in terms of kilograms. We will be excluding (for seed input comparison only) plots sown to sugarcane, onions, chillies, etc.

5) The data do not provide information on the amount of water that is used for irrigation in any operation. However, one of the operations listed in the schedule is "irrigating crops." The total number of times this operation is undertaken on a plot could be taken as an indicator of the importance of irrigation on that plot. The larger the number, the greater is the use of irrigation.[16] Clearly, in the absence of information regarding the amount of water available during each such

16. If, owing to shortage of water, a plot is fully irrigated only in instalments (i.e. covering part of the plot every day for several days) the number of irrigations given in such cases is calculated as one. The mid-period date is given as the date of operation.

operation, this measure is at best a crude one. Moreover, it makes no distinction between different types of irrigation and their quality.

6) Finally, we must mention another simplifying procedure we had to adopt. This applied to all inputs, but mainly labor. While recording input data it was sometimes the case that labor and other inputs were used on a plot A at the land preparation stage. Subsequently, for sowing the plot was divided into subplots AA and AB and planted to different crops. To determine the total input on AA and AB it is necessary to know how the inputs applied on A were distributed on the parts that later came to be called AA and AB. Since this is not recorded, we are forced to distribute the total inputs applied on A between AA and AB in proportion to their respective areas. However, this simplication may not create any inaccuracy since most of the operations done during land preparation, for example, plowing and harrowing were done uniformly on the original plots prior to subplotting.

In Tables 4 and 5 we present simple mean input comparisons on sharecropped and owner-operated land in Kalman and Shirapur, respectively. We see that:

1) In both villages, input intensities on owner-operated plots are greater than on sharecropped plots. This applies to all inputs, whether they are hired or not. However, these differences are more marked in the case of owned inputs.

Table 4. Average input per hectare on sharecropped and owner-operated plots in Kalman, 1975-76.

Average per ha input of	Share-cropped plots[a] ($\bar{x}_s$)	Owner-operated plots[a] ($\bar{x}_o$)	Difference $\bar{x}_o - \bar{x}_s$	t-value
Labor hours:				
Male family	77	158	81	1.39
Female family	40	94	54	1.70**
Child family	-	2	2	1.03
Total family	116	254	138	1.55
Male hired	77	126	49	1.16
Female hired	138	210	72	0.55
Child hired	-	0	0	0.98
Total hired	215	336	121	1.18
Total	331	590	259	1.65**
Owned bullock	57	96	39	1.25
Hired bullock	2	15	12	1.79**
Total bullock	59	111	52	1.50
Kgs. of urea fertilizer	-	5	5	1.61
Kgs. of complex (15:15:15) fertilizer	-	2	2	1.25
Kgs. of all fertilizer -types combined	-	15	15	2.25**
Quintals of farmyard manure	0	5	5	2.37**
Quintals of manure from penning of sheep, etc.	-	-	-	-
Quintals of all manure types combined	0	7	7	1.44
Number of irrigations	2	7	5	1.42
Kgs. of seed	20	25	5	0.75

a Number of owner-operated (sharecropped) plots = 288 (77)

** Denotes t significant at 5% level using a one-tailed test.

Table 5. Average input per hectare on sharecropped and owner-operated plots in Shirapur, 1975-76.

Average per ha input of	Share-cropped plots[a] ($\bar{X}_s$)	Owner-operated plots[a] ($\bar{X}_o$)	Difference $\bar{X}_o - \bar{X}_s$	t-value
Labor hours:				
Male family	64	284	220	1.88**
Female family	109	203	94	1.16
Child family	2	12	10	0.73
Total family	175	499	324	1.79**
Male hired	47	64	17	0.55
Female hired	109	227	116	0.79
Child hired	-	0	0	0.38
Total hired	156	291	136	0.85
Total	331	790	459	1.53
Owned bullock	25	64	39	1.40
Hired bullock	10	32	22	1.61
Total bullock	32	96	64	1.82**
Kgs. of urea fertilizers	-	7	7	0.85
Kgs. of complex (15:15:15) fertilizers	-	2	2	0.32
Kgs. of all fertilizer types combined	-	7	7	0.73
Quintals of farmyard manure	0	10	10	1.03
Quintals of manure from penning of sheep, etc.	-	2	2	0.93
Quintals of all manure types combined	0	10	10	1.09
Number of irrigations	-	10	10	1.25
Kgs. of seed	20	20	0	0.09

a Number of owner-operated (sharecropped) plots = 201 (14)
** Denotes t is significant at the 5% level using a one-tailed test.

2) In Kalman both sharecroppers and owner-operators use relatively more hired labor compared to family labor, while in Shirapur the reverse is true. However, in both villages a much larger proportion of total labor hours derive from hired labor on sharecropped land vis-á-vis owner-operated land.

3) As far as the use of family labor is concerned, relatively more of it is male labor (rather than female labor) on both sharecropped and owner-operated plots. The reverse is the case in the use of hired labor. More hired labor is female labor on both sharecropped and owner-operated plots.

4) When tested the null hypothesis that the average input intensities are the same on owner-operated plots and sharecropped plots against the alternative hypothesis that the average inputs intensities are larger on owner-operated plots the results were: (i) in Kalman, inputs of female family labor, total labor, hired bullock labor, total fertilizers, and farmyard manure, are significantly greater on owner-operated land; (ii) in Shirapur, inputs of male family labor, total family labor and total bullock labor are significantly greater on owner-operated land; (iii) inputs of irrigation, seeds, and different types of fertilizers are not significantly different on owner-operated and sharecropped land in either of the two villages.

Our simple mean comparisons provide some insights regarding the use of inputs on rented and owner-operated land. However, in these comparisons we do not control for the other important factors which may be influencing the use of inputs. One important variable would be the cropping pattern. Thus, differences in input use could arise because of differences in cropping pattern rather than tenancy per se. Irrigation is another important variable. It allows more intensive cropping and it influences the cropping pattern as we saw in the last section. In either way, it is likely to influence the extent of use of inputs. We are also ignoring in our comparisons cultivator-specific differences which could influence the pattern and extent of input use.

To take account of some of these limitations we report results from a multiple regression analysis where we seek to explain variations in the use of inputs per hectare in terms of independent variables like the extent of tenancy on the holding, the command area under irrigation, the area allocated to drought-sensitive crops, and the dependent/worker ratio in the cultivating household. These data are available for each holding cultivated by the sample households.

In Table 6 we present coefficient estimates for each of seven regression equations where each of the dependent variables listed in column (i) is regressed on a common set of explanatory variables. From Table 6 we see that:

Table 6. The effect of tenancy, resource endowment, and cropping pattern on the use of human labor.

Dependent variables/ village	Independent Variables					R^2
	Leased-in area as % of total operated area[a]	Command area under irrigation as % of total operated area	Area under drought sensitive crops as % of total cropped area in both seasons	Land owned per worker	Dependent/ worker ratio	
Family male labor hours/ha						
Kalman	-0.31	0.84	0.09	-16.78*	-6.98	0.24
Shirapur	-3 51	1.70	1.25	-45.32	-90.20	0.25
Combined	-1.82*	-0.78	3.06*	-48.1**	-26.30	0.25
Family female labor hours/ha						
Kalman	-0.2	0.41	0.25	-18.9**	22.8**	0.46
Shirapur	-1.56	0.86	0.89	-60.2**	48.20	0.62
Combined	-0.96**	-0.59	2.7**	-43.9**	32.10**	0.61
Total family labor hours/ha						
Kalman	-0.48	1.23	0.38	-35.7**	16.10	0.43
Shirapur	-5.15	-2.31	2.38	-102.8*	-40.00	0.39
Combined	-2.84**	-1.56	5.94**	-92.0**	7.86	0.43
Hired male labor hours/ha						
Kalman	-0.31	0.82	2.4	-0.10	5.36	0.22
Shirapur	-0.17	-0.13	2.12	-12.00	4.68	0.23
Combined	-0.32	0.03	1.26*	-1.65	-2.06	0.14
Hired female labor hours/ha						
Kalman	-0.26	0.63	3.46	11.40	-10.26	0.26
Shirapur	-0.17	6.89*	3.94	13.90	-1.26	0.75
Combined	-0.25	2.26	7.42**	-0.51	9.41	0.65
Total hired labor hours/ha						
Kalman	-0.57	1.46	5.86	11.4	-4.74	0.24
Shirapur	-0.05	5.62	5.96	1.2	3.66	0.69
Combined	-0.58	2.29	8.67**	-2.39	7.40	0.59
Total labor hours/ha						
Kalman	-1.04	2.69	6.25*	-24.30	11.35	0.36
Shirapur	-5.19	7.94	8.34	-101.60	-36.33	0.66
Combined	-3.42*	0.73	14.61**	-94.40**	15.26	0.64

a. We have omitted the constant term; ** denotes t is significant at 5% level; * denotes t is significant at 10% level.

1) Households leasing in more land use less of all types of labor per hectare. However, this difference in use of human labor on leased-in land is significant for family labor but not so for hired labor. Thus owner-tenants appear to divert more of their family labor to their owned land.

2) While relatively more labor appears to be used on holdings with better irrigation facilities, the regression coefficients for irrigation are not statistically significant for any type of labor.

3) The use of labor is significantly higher on holdings devoting relatively more land to drought-sensitive crops.[17]

4) Households with a relatively large number of workers in relation to their land ownership utilize more family labor per hectare. This is true for both male and female labor. The use of hired labor does not appear to be related to the number of workers in the household. As far as the total labor input is concerned, families with a larger number of workers will apply labor more intensively on operated land.

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17. We observed in Table 3 that the area allocated to drought sensitive crops was related to the extent of irrigation on the holding, so that when we include both irrigation and area under drought sensitive crops as explanatory variables in our regression there would be specification problems. The insignificant coefficient for irrigation that we observe may in part be a result of our specification problem.

5) The use of male family (hired) labor is less (more) on holdings cultivated by households with more dependents per worker. Conversely, the use of female family (hired) labor is greater (less) on holdings cultivated by households with a larger number of dependents per worker. These differences are, however, not significant (except for the use of female family labor).

In Table 7 we analyze the determinants of the intensity of use of bullock labor with the same procedure. Observe that:

1) Households leasing-in more land tend to use less bullock labor on operated land. However, the influence of tenancy on use of bullock labor is not statistically significant (except for the hired component).

2) Similarly, while irrigation encourages greater use of bullock labor, its influence is not statistically significant.

3) Total input of bullock labor hours is greater on holdings with a larger percentage area under drought-sensitive crops. However, the cropping pattern does not appear to affect the proportional use of owned and hired bullock labor inputs.

4) By far the most important variable affecting the use of bullock labor on land is the household's ownership of bullocks. Households

Table 7. The effect of tenancy, resource endowment, and cropping pattern on the use of bullocks.

Dependent variable/ villages	Independent variables					
	Leased-in area as % of total operated area[a]	Command area under irrigation as % of total operated area	Area under drought-sensitive crops as % of total cropped area in both seasons	Value of bullocks owned per ha of land owned (Rs/ha)	Dependent/ worker ratio	R^2
Owned bullock labor hrs/ha						
Kalman	-0.30	0.24	1.00*	0.10**	-7.71	0.55
Shirapur	0.14	0.63	-0.07	0.06**	1.41	0.50
Combined	0.02	0.45	0.31	0.06**	-6.91	0.46
Hired bullock labor hrs/ha						
Kalman	-0.10	0.09	-0.49*	-0.05**	3.96	0.54
Shirapur	-0.67	-0.24	0.79	-0.04**	-20.52	0.37
Combined	-0.43**	-0.24	0.43	-0.03**	-1.68	0.25
Total bullock labor hrs/ha						
Kalman	-0.40	0.34	0.51	0.06**	-3.75	0.35
Shirapur	-0.53	0.39	0.72	0.02	-19.11	0.44
Combined	-0.41	0.21	0.75**	0.03**	-8.59	0.42

a We have omitted the constant term
** denotes t is significant at 5% level
* denotes t is significant at 10% level

owning more bullocks (in terms of value) use significantly more bullocks labor on their land.[18]

In our comparison of means we found that the use of fertilizers (all types) and manure (all types) was larger on the owner-operated areas vis-á-vis those sharecropped. This difference, however, was not significant. This finding is confirmed by our regression analysis (Table 8). We observe from the table that:

1) The input of fertilizers and manure is relatively less on holdings with a larger area under tenancy. However, the tenancy coefficient is not statistically significant.

2) Cropping pattern is by far the most important variable influencing the extent of use of fertilizers and manure. In both villages, the use of fertilizers and manure is significantly larger on holdings with a larger percentage area devoted to drought-sensitive crops.

3) The use of manure (but not fertilizers) is significantly higher on better irrigated holdings.

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18. The possible simultaneity problem that we came across in our earlier regression is more severe in this case. Specification problems are likely to arise if the irrigation variable and the area under drought-sensitive crops are both included in the set of explanatory variables. In addition to this, we are including two more variables which are also related to one another, viz. the extent of leasing and the extent of ownership of bullocks.

Table 8. The effect of tenancy, resource endowment, and cropping pattern on the use of fertilizers and manure.

Dependent variable/ village	Independent variables					R^2
	Area leased-in as % of total operated area[a]	Command area under irrigation as % of total operated area	Area under drought sensitive crops as % of total cropped area in both seasons	Land owned per worker (ha)	Dependent/ worker ratio	
Total fertilizer (kgs) per ha						
Kalman	-0.17	-0.06	1.1**	-3.35	3.27	0.30
Shirapur	0.01	0.21*	0.23*	0.31	1.85	0.83
Combined	-0.04	0.17	0.31**	0.80	1.14	0.31
Total manure (quintals) per ha						
Kalman	-0.02	0.28**	0.04	-0.17	-2.02	0.35
Shirapur	-0.06	0.07	0.47**	-0.84	2.41	0.71
Combined	-0.05	0.21	0.33**	-1.05	0.07	0.60

a We have omitted the constant term
** denotes t is significant at 5% level
* denotes t is significant at 10% level

4) Neither the number of workers nor the composition of the household has any significant influence on the use of manure or fertilizers.[19]

SUMMARY AND CONCLUSIONS

We first examined the role of a household's resource endowment in its land leasing decision. We found that households with relatively more bullocks tended to lease-in more land. However, neither the number of workers in a household nor the composition of the household in terms of the ratio of workers to dependents was found to influence the extent of land leasing by the household.

We also analyzed cropping pattern differences on tenant and owner -operated plots. Owner-operated plots had a larger area under drought sensitive, high valued, labor-intensive crops compared to sharecropped plots, but this difference in allocation was not statistically significant. In fact, if we control for irrigation differences on owner-operated and sharecropped plots, then cropping pattern differences could not be observed.

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19. The problem arising because of the inclusion of both irrigation and area under drought-sensitive crops in the set of explanatory variables is present in this case also.

Our examination of input use differences on sharecropped and owner-operated plots reveals that there are no significant differences in the use of seeds, irrigation and manure but the use of labor (human and bullocks) may be greater on owner-operated lands. However, factors other than tenancy (e.g., the ownership of bullocks in a household, the availability of family labor, or the allocation of land to drought-sensitive crops) may be more relevant variables explaining input use differences.[20]

What do these conclusions suggest for policy? There are two points that could be made. Firstly since tenancy (particularly sharecropping) does not appear to lead to a less intensive use of inputs compared to owner-operated land, this argument against tenancy is invalid. It ignores the wide diversity in the terms and conditions in sharecropping contracts (for example, cost-sharing, low interest production loans from landowner to tenant, etc.) that ensure intensive use of inputs by sharecroppers. Thus, the objective of maximizing agricultural output does not necessitate the elimination of sharecropping. Other measures, like the extension of irrigation facilities and the provision of credit and other inputs to the poorer cultivators, may be important.

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20. One reason for these negative results could be that in the SAT areas (except in the irrigated regions) the season's weather and region-specific soil conditions so greatly restrict the options in terms of crops, management practices, and input use, that inter-farm differences in tenure status or resource endowment do not register their impact.

Apart from the objective of maximizing production, the composition of agricultural output could be another policy consideration. In so far as we have shown cropping pattern differences are not influenced by tenancy, this suggests that significant changes in tenancy arrangements would not be required for achieving a change in the desired output mix.

In the previous paragraph we had argued that the condemnation of tenancy (particularly sharecropping) on grounds of less intensive production is, in general, not justified. In fact tenancy may have useful functions to perform and one such function was illustrated by our analysis of tenancy and household resource endowments. We found that when there are imperfections in the credit market and when the market for bullock hire services either does not exist or functions imperfectly, then tenancy serves the purpose of adjusting the household's fixed supply of bullocks to the land cultivated by it. Thus, in the context of market imperfections, ownership of bullocks is an important constraint on leasing. This has at least one important implication for policy. If, as is likely to be the case, the extent of ownership of bullocks is a reflection of the household's wealth and asset position in the rural economy, then our results suggests that to a large extent tenancy takes the form of relatively richer households leasing-in land from poorer households who do not have sufficient bullocks or other resources. Jodha (1979) has made the same point. Moreover, since households may be leasing-out their land because they do not possess adequate draft animal labor, it is likely that land reform measures that only provide land to the landless will not succeed, unless supplementary measures to provide inputs such as bullocks are simultaneously introduced.

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