Short Term Investment in Agriculture: Is there a Gender Bias?

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Abstract

Most developing countries strive to improve agricultural productivity by relaxing credit constraints, supplying better inputs, improving marketing and distribution. However the efficacy of these reforms needs to be examined in the context of the behavioral responses of farming households. This study examines gender biases within households that affect short-term investments in agriculture. The study utilizes data from ICRISAT's village level studies in India (1975-85) to highlight the effects of child gender on the use of agricultural inputs. The main finding is that households with boys tend to use purchased inputs such as fertilizers and insecticides more intensively compared with households with girls. In general, household with boys also tend to have larger land holdings, and use animal and human labor to a greater extent than household with girls.

Selected paper prepared for presentation at the annual meeting of the American Agricultural Economics Association, Portland, OR 31 July 2007

† We are grateful to ICRISAT for providing data and to William Masters and Kathryn Boys for their help, comments and suggestions. This SANREM CRSP research was made possible through support provided by the Office of Agriculture and Food Security, Bureau for Global Programs, U.S. Agency for International Development, under the terms of Award No. PCE-A-00-98-00019-00. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Agency for International Development.

1 Introduction

This paper measures the impact of household demographics on agricultural investments. We study the effects of child-gender on short-term investments in productive inputs, asking whether the behavior of households with a male child differ from those without. We test a simple hypothesis using a straightforward approach. We ask whether having a male child increases the marginal investment in land compared with having only a female child.

Increasing agricultural productivity remains a priority for most developing economies. Although the Green Revolution minimized food shortages to a large extent, malnutrition and hunger persist. In rural and agrarian economies, improvements in health and nutritional outcomes are brought about by direct investments in nutrition, health and/or through improvements in agricultural production and practices. As a result, governments and donors continue to engage in efforts to boost agricultural productivity by relaxing credit constraints, supplying more and better inputs, improving distribution and marketing networks, and minimizing discrimination against female farmers. However, the effectiveness of these reforms must be examined in the larger context of the targeted population and potential behavioral responses to incentives.

As an example, consider households with a given level of income which it allocates to consumption and savings/investment. The proportion of income spent by households on food, nutrition and health (investments in human capital) or on agricultural improvements is, in turn a function of various factors. Some of these include prices, education, farm size, wealth, credit constraints, labor and access to complementary inputs and demographics such as age and sex of household members.

Demographic features of the household, such as age and gender composition of the farm family act as important conditioning factors for household behavior. The gender-mix of children in the household is—assuming gender-selective abortion is not practiced—an exogenous variable. But in many developing countries there seems to be a marked "son preference," which is understood to arise out of socio-economic pressures (see the discussion below). Numerous studies document this preference for males and it is possible that this preference introduces different behavioral attitudes, especially toward land and agriculture. Thus, efforts to intensify agricultural production and improve food and nutrition can be enhanced or minimized by the prevailing norms and beliefs that condition household behavior.

In this context, this study will attempt to highlight differences, if any, in the way rural households behave towards cultivation and field operations when they have sons or daughters. We can expect that households with more males would tend to invest more in agriculture for various reasons. These could range from having more manpower and labor to facilitate work to such considerations as inter-generational transfers of land and accumulated wealth. In response, the intensity of cropping and agricultural productivity could well be determined not only by technology and credit constraints but also by perceptions regarding the relative economic value of girls and boys.

2 A brief review of the literature on gender bias

Discussions on gender tend to focus on discrimination against women and children. There is vast sociological/psychological literature on prejudices based on the gender of children within a household. Several studies indicate that the behavior of parents towards marriage, fertility and even resources can vary depending on the gender of the child (Lundberg, 2005; Clark, 2000).

Although examples of gender based discrimination abound in sociological literature, there is evidence of gender-based discrimination in economic literature as well. Economists have tended to focus on the allocation of resources within the households. Intra-household allocations have also been explored in detail (Kanbur and Haddad, 1994; Behrman and Deolalikar, 1990; Deaton 1989, 1995; Deaton et al., 1989; Quisimbing et al., 1995; Pitt, Rosenzweig and Hassan, 1990).

Other examples of gender-based discrimination include women's access to credit markets (Morris and Meyer, 1993), effects of men and women's incomes on health, nutrition and education of children (Strauss and Thomas, 1995), women and natural resource management (Agarwal, 1997), differential household behavior depending on the gender of the household head (Doss and Morris, 2001). The impact of having a son or a daughter on household income and wages, savings and/or time allocation by parents has been studied in many traditional and non-traditional societies (Deolalikar, and Rose, 1998; Lundberg, 2002).

Recent studies in development have questioned the assumption that the household is the basic unit of analysis wherein all incomes are pooled and resources allocated equally across members (Alderman et al. 1995; Udry 1995). Given the "son preference" in South and South East Asia, several studies examined the issue of households functioning as a single unit wherein all incomes are pooled and all resources are allocated equally. At the simplest level, high mortality rates among women in most developing countries are symptomatic of a gender based discrimination that is not visible.

Behrman and Deolalikar (1990) using ICRISAT data from a sample of villages in rural India find that women are more prone to food shortages and malnutrition. Intra-household variances range from 15% to 48% for various nutrients indicating that nutrient intakes may not be the same among household members. Food price elasticities are generally negative for women and girls suggesting asymmetric treatment of women, especially in periods of food shortage and insecurity. They conclude that the burden of a food shortage falls disproportionately on women and girls, and that—in their sample—the deprivation experienced by females during food shortages amounts to gender discrimination. In contrast, using consumption expenditure data from the National Sample Survey of India, Deaton (1989) does not find any evidence of discrimination in the allocation of goods within a household.

Kebede (2003) uses data from Ethiopia to test if there is evidence of discrimination against females. Following Deaton's outlay equivalent approach he uses the quadratic AIDS model and also address the issues related to exogeneity of income, prices, and panel data to control for fixed effects and censoring since many commodities are not used explicitly during survey periods. The results show that females have higher income and price elasticities as compared to men implying that the effect of income and price shocks are most likely to be absorbed by females.

The main idea in the above mentioned studies is to quantify the reduction in expenditure on adult goods when there are male or female children. Some of these papers find little evidence of discrimination against girls which can be attributed to the sampling methodology (Udry, 1995).

The persistence of widespread malnutrition and hunger especially among small householders has focused increasing attention on issues regarding dissemination and adoption of agricultural technologies by farmers. An important aspect of this is gender-based differential rates of technology adoption. Using data from Ghana, Doss and Morris (2001) examine whether the inclusion of gender, specifically the gender of the household head can explain technology adoption decisions. The authors focus on two different technologies: modern varieties of maize and chemical fertilizers. Using a two-stage probit model, the authors conclude that gender *per se* does not have any effect on the rates of technology adoption. However if the technology requires complementary inputs such as access to land, labor, extension services etc, impacts of the adopted technology will not be gender neutral, especially if female farmers have limited access to complementary resources.

By and large, the inclusion of demographics as explanatory variables has been limited to using the gender of the household head and educational attainments. The impact of family composition has not been explored in detail in mainstream economics. A few studies that focus on the wages and time allocation by parents indicate that having male children in the family, serves to increase productivity of fathers. The increase in the hours worked by men was much more if they had a son as compared to the increase on account of a daughter (Lundberg and Rose, 2002).

For the Philippines, Estudilloa et al. (2001) found a marked difference in lifetime incomes arising from parental preferences in the allocation of land inheritance and investments in schooling between sons and daughters. Sons were found to be preferred with respect to land inheritance, receiving 0.15 additional hectares of land, while daughters were treated more favourably in schooling investments, receiving 1.5 more years of schooling. This suggests that Filipino parents allocate intergenerational transfers to equalize incomes among their children, without sacrificing efficiency. These differences are not mirrored in developed or wealthy societies, however. For example, Taubman (1991) reports that both sons and daughters have comparable levels of education, nutrition and tend to be treated equally with regard to inheritances etc.

Nevertheless, the gender of the child can have an impact on the parental behavior, fertility rates, earnings and wealth of a household. Evidence from India suggests that with the exception of the South Indian state of Kerala, the entire country has a sex ratio which is unfavorable for women. On account of economic, social or religious reasons, there is a strong desire to have sons especially among rural Hindu and Muslim women (Clark, 2000). Economic factors alone do not account for the pervasive son-preference in the community: sons have a deeper cultural significance which persists even when widows are financially well-off or independent (Vlassoff, 1990).

Various factors can be responsible for the influence of gender on family behavior. For instance, social and cultural norms could emphasize the role of males as a household head and means of familial support especially in old age. Also women could be associated with an increased economic burden especially on account of marriage and dowry (Jaggi, 2001, Anderson, 1999). Inheritance laws favoring inter-generational transfers of land and property among men can also be responsible for strengthening the desire to have sons. Despite the fact that women often work on farms and constitute an important element in household production, the economic value of a woman's labor is lost to the family after marriage. A desire to retain immovable assets within the family also can give rise to preferential treatment of sons under the assumption that they will not split the family after marriage. Economic treatment of this "son preference" can be found in the work on bequest behavior and marriages. Using a Game-theoretic approach, Zhang (2001) shows that a Nash equilibrium exists when bequests are non negative and all bequests are left to the male child.

All of these findings point to the plausibility that the gender of the child will act as an important exogenous variable influencing several household decisions. Child gender can independently affect investments in land by way of cultivation practices such as fertilization, manuring, drainage, etc. or improvements in technology or even conservation of land. From a policy making perspective, it is necessary to account for differential treatment of individual household members that results in inequities within households. Failure to do so can give rise to problems of asymmetric information and moral hazard that may actually undermine the effectiveness of policies based on the household as a unit of analysis (Fuwa et al., 2006). For instance, in most LDCs, meals are provided to school children to improve their nourishment. However these may be viewed by recipients as a substitute for meals at home resulting in their being given less food at home (Fuwa et al., 2006). Similarly, institutional norms and customs prevailing in society can result in differential access to economic resources. This can possibly become an underlying cause of conflict and discrimination with in the household.

To measure potential gender-based differentials in agricultural investments, below we focus on agricultural land and the use of agricultural inputs. From a bequest point of view, even a weak preference for sons would imply that the major share of the wealth including land will be left to sons. In that case, the incentives to work on land and intensify production or adopt conservation practices may be conditioned by the gender-mix of children within a household. It is our contention that in rural and agrarian societies, adoption of technology or conservation practices or simply cultivation are a function of not just insurance, credit, inputs but also the gender of the children, income and educational attainment of the household members.

3 Study site and data

This study examines farm households from a group of villages in rural India. The farms are located in the semi-arid tropical belt. Several government sponsored schemes such the Employment Guarantee Scheme and the Public Distribution System providing subsidized foods are in operation here. With regard to "son preference" the region does not rank very high compared with northern India. Some evidence of discrimination against women and children is provided by Behrman and Deolalikar (1990) and Clark (2000).

In general, the legal system in India is geared towards ensuring fair treatment of women. Inheritance laws have become more egalitarian allowing *Hindu* women to have an equal share in their family's wealth and assets including agricultural land. The practice of dowry at the time of marriage and sex determination of the fetus is abolished by law. Yet, anecdotal evidence suggests that these malpractices are still rampant, especially in rural areas.

Data for this analysis come from the ICRISAT VLS (International Crops Research Institute in Semi-Arid Tropics, Village Level Studies) for Rural India. The VLS are panel data collected at regular intervals in six villages from 1975-85. The survey covered 240 households. It was discontinued in 1985 but restarted in 2000. The major objective of the VLS was to understand the socioeconomic, agro-biological, institutional constraints to agricultural development in semi-arid tropical areas. We use data from schedules C and Y of the survey.

For analysis, since this study looks at family composition, an indicator variable was created that takes the value of 1 if there was at least 1 boy in the household and 0 if there was none. Similar variables were constructed for households with only girls. These data were merged to obtain a complete dataset consisting of demographics and farming data. The final data set used for this analysis includes 249 households in 8 villages over a period of 10 years. Childless households were excluded from the dataset.

A key assumption in this analysis is that the sex of the child is determined exogenously. The basis for this assumption is that sex selection techniques would not have been available in rural Indian villages during 1975-84. At present, sex determination is illegal in India.

4 Basic patterns in the ICRISAT data

The main hypothesis of this study is that the gender of the children within a household has an effect on farm-level decision making. At the outset we examine the age and gender structure of the population for two selected years (1975 and 1984).

Table 1 shows the percentage of households in different land classes for households with boys and girls.[1] The definition of farm size varied from village to village; therefore these estimates are based on the variable "land class" given in the survey data. The table shows the distribution of households according to village and the gender of the children for 1984. Overall, 75 per cent of households had at least one female child in the age group 0-15 years; 77% had at least one boy in the age group 0-15 years; 24% had only boys and 23% had only female children. The average household size was 7.6 members.

In 1984, Village F had the highest number of households with girls (100%) followed by village D (90.91%) and village E (80.95%). In contrast, 100% of the households in village F had at least 1 boy and 95.24% in village E had a boy. 29% of the households in village H and 33% in village A had only female children. The percentage of households having only male children was highest in village B (31.25%) and villages G and C (30%) In general the number of boys in the population is much greater than the number of female children. Since we assume that the gender of the child is exogenous and that sex selective abortion is not practiced, this could imply that people have more children in an attempt to have a boy. Interestingly, with the exception of villages B and H, household size tended to be smaller in villages with a relatively larger number of households with boys. It ranged from 6.4 in village B to 9.8 in village F. The predominance of men in the population and the slightly smaller household size suggests

[1] A household consists of those living together and consuming food from a common kitchen. Land class is defined in the VLS based on operational holding. These take on values 0, 1, 2 and 3, ranging from labor, small, medium and large respectively (Manual of instructions, ICRISAT).

that the birth of a boy results in smaller families. Households with girls are more likely to have children till they have a boy.

Table 2 presents some results on the land class, field activities and the use of animal and human labor. We find that 8.3% of the households with only girls are agricultural labor households whereas 50% are large landholders. On the other hand, none of households with only boys fall into the agricultural labor class whereas 36% are large farmers. Households with at least one boy are mainly distributed across small (26%), medium (30%) and large landholding classes (36%). The average cultivated area for households with girls is 9.2 acres, less than a quarter of which is irrigated. The average cultivated area for households with at least one boy is 8.7 acres, with approximately a third irrigated. Households with only boys have on average 7.6 acres of cultivated land, 38% of it irrigated. Perhaps the presence of a boy induces deliberate acquisition of land either through purchase or leasing in.

The lower panels of Table 2 also show cultivation activities carried out by households according to the gender of children. While general field preparation, sowing and harvest are performed by all households, fewer households with only girls (66%) engage in fertilization of land, manuring, (54%), plant protection (17%), weeding (33%) and harvesting of by- products (63%). In contrast 88% of households with only boys use fertilizers, 64% use manures, 64% carry out activities such as weeding, harvesting of by products (68%), irrigation (76%). Activities appear to be defined to some extent by gender. There are distinct activities such as interculturing, resowing, nursery cultivation that are performed to a greater extent by households with girls only.

Agricultural inputs used were divided into 4 groups: fertilizers, insecticides, manures and pesticides. With the exception of insecticides, the average level of use of all other inputs was higher in households with boys. The use of fertilizers by households with only boys averaged 242 kg compared with 145 kg by households with only girls. The use of manure also was comparatively higher for households with only boys (73 kg) compared with households with only girls (48 kg).

Examining the use of human and animal labor by households with different demographics, we find that on average the animal and human labor use hours were higher for households with boys/only boys. Animal labor hours averaged 253 hours for households with only girls and 255 hours for households with only boys. The use of family males was 463 hours for girl households and 763 hours for households with boys. The use of hired labor, both men and women was again higher for households with boys. The interesting exception to this trend is the labor hours expended by a family child. Girl households on average expended 23 hours whereas the use of a family child was restricted to 10 hours for households with at least one boy and 8 hours for households with only boys. This may point towards somewhat asymmetric treatment of girls and boys. While the agricultural operations conducted by boy households appear to be more intensive, there is also a tendency to use the labor of boys sparingly. Perhaps they engage in education and other activities.

Agriculture involves manual labor to a great extent. The role played by women in agriculture cannot be over-emphasized. Women's activities are often the most important in producing a finished product. A cursory examination of our evidence suggests some farming decisions may be influenced by family composition. In particular, the presence of male children seems to lead to more hours being worked on the farm and more intensive use of some inputs.

5 Regression results

To investigate the patterns described above in a multivariate context we turn to regression analysis. The dataset contains 657 observations over the 10-year period, and 249 unique household observations. For purposes of this paper we use ordinary least squares for the regressions, putting observed input levels on the left-hand side of a series of regressions and gender composition variables on the right-hand side. These choice variables are contemporaneously correlated, suggesting a seemingly unrelated regression (SUR) approach, but since we use an identical set of explanatory variables in our regressions, the GLS estimator of SUR is the same as the OLS estimator obtained using single equation methods. For the time being, we do not take explicit account of the longitudinal nature of the data, but do correct for heteroskedasticity using White's standard errors. We use reduced form equations of the form:

input intensity = f (child gender, education, area, land values, location)

where the dependent variable is the intensity of input use, computed as the quantity of input used on a plot divided by the total plot area. The inputs of interest are fertilizers, manures, insecticides and pesticides.

To begin we use two specifications to examine the effect of a boy and other variables on the use of inputs. In the first series, reported in Table 3, input intensity is regressed on indicator variables that equal one for (i) households with only girls, (ii) households with only boys and (iii) households with at least one boy and at least one girl. Irrigated area and land value are also included as regressors.[2] In the second set of models, reported in Table 4, input use intensities are regressed on "boy," the highest education level attained by any member of the household, the irrigated area and a set of binary village indicators.

Table 3 indicates that relative to a household with only girls, the total average fertilizer intensity on a plot is 22.2 kg/acre higher in the presence of a boy and 25 kg/acre for households with only boys and no female children. For boy-only households the use of manures is 24 kg/acre higher than for girl-only households. On average, boy presence has a positive and significant (but negligible) effect on the use of insecticides.

As expected, the sign of the coefficient on irrigated area is positive for fertilizer, manure and insecticides, and in the case of fertilizer results indicate that an increase in the level of education would result in higher use of purchased inputs. The coefficient on land value is negative and significant for manure and pesticide use. Perhaps an increase in the potential sale value of the land decreases the incentive to cultivate it intensively.

Results from Table 4 indicate similar patterns. The indicator for "only boy" is positive and significant for manure use, which is 33 kg/acre higher for this group compared with the base value of 24 kg/acre for households with only girls. The correlation between presence of a boy and use of insecticides and pesticides is positive and weakly significant. The presence of a boy is positively and significantly correlated

[2] Land values per acre (in 100 Rupees) are based on information obtained from either *patwari* or some knowledgeable person in the village. The values reflect the potential sale value of the plot considering location, irrigation, topography, etc.

with fertilizer use, however, the magnitude of the correlation is smaller than for a household with only girls. The level of education attained, as indicated by “diploma” by a household member, is not significantly correlated with input use in this model. Land values are negatively correlated with use of fertilizers and manures at statistically significant levels. As expected, total irrigated area has a positive and significant correlation with the use of fertilizers.

To look at the data from a different perspective, Table 5 presents the first of two regressions for different land classes. Land class refers to the ownership of land and takes one of four values: landless, small, medium or large. Here we combine the sample of medium and large farms and run separate regressions for each of the groups of landowners. Results in Table 5 indicate that, for small landowners, the presence of a boy has a positive and significant correlation with the use of insecticides and a negative and significant correlation with use of fertilizers. Although the use of insecticides and fertilizers appears to be higher for households with girls, the correlations are not statistically significant. Interestingly, higher educational levels are negatively correlated with the use of fertilizers, manure and insecticides and these effects are statistically significant. It is possible that this may reflect diversification into other occupations in households with better opportunities. The combination of small farms and high educational attainment likely leads households to move into other occupations, thereby reducing incentives to invest in agriculture and cultivation. Land values again have a negative and significant correlation with the use of fertilizers and manures.

Turning to households in the medium and large landowning classes (Table 6) regression results reveal higher cultivation intensity in the presence of boys. Relative to households with only girls, the use of fertilizers is higher by 38 kg/acre and the use of manure is higher by 14 kg/acre in households with only boys. Again, the presence of male children has a negative and significant correlation with pesticide use. Irrigated area has a positive and significant correlation with the use of fertilizers and manures as expected. Land values are negatively correlated with use of fertilizers and manures at statistically significant levels. Once again the effect of education is positive although statistically insignificant. Results confirm that the presence of a boy is correlated with higher intensity of fertilizer and manure use; this correlation is statistically significant.

The patterns exhibited in these models with respect to the correlation between the presence of boys and the intensity of input use is even more pronounced when we examine households with different land owning status. This is done in tables 7, 8 and 9. We find, not unexpectedly, that households which own significant amounts of land are likely to invest more in agriculture compared with those that operate small land holdings. Tables 7-9 present results of regressions for different categories of land value. For farms with very low land values (up to Rs. 5000/acre), the only significant gender variable is presence of a male child, which is positively and significantly correlated with the intensity of fertilizer and manure use. As land values increase we find that the increase in the use of fertilizer and manure intensity is large and statistically significant relative to an only girls households. Irrigated area has a significant and positive effect on fertilizers and manures intensities as expected. Land value and higher education still exert a negative influence on the use of inputs. At very high land values (Rs. 21,201-292,100/acre, Table 9) adding a boy to an only girls household increases the use of fertilizers from 10 kg/acre to 16 kg/acre and increases manure use from 4 kg/acre to 10 kg/acre. Irrigated area has a positive effect on the use of fertilizers and manures while land values have a positive and significant effect on the use of insecticides and pesticides.

The general picture that emerges from the results reported above is that having a boy in the household has a positive and significant correlation with the intensity of input use, especially fertilizers and manure. Land values have a negative correlation with input use intensity. A unit increase in irrigated area increases the use of fertilizers and manures but has no significant impact on insecticides and pesticides as expected. Finally, the effects of higher education are ambiguous. This perhaps points to opportunities for diversification into other occupations as family members attain more education.

6 Conclusions

The objective of this study was modest: to examine whether a gender bias might exist that influences household decision-making with regard to farming. A brief description of the data clearly indicates the potential for a bias in favor of males in the population. Certain activities such as fertilization of the soil, weeding and manuring are carried out to a larger extent by household with boys. This could point toward an inherent bias in agriculture which is “man” power intensive. The use of inputs and human and animal labor is also higher for household with boys. Regressions confirm that household demographics are correlated with input use. The presence of a boy was found to be positively correlated with the intensity of fertilizer and insecticide use in most of the regression formulations explored here.

Although we leave it for future efforts to explore these patterns in greater econometric detail, drawing on the panel nature of the data, in the light of these findings we feel confident in concluding that gender composition inside agricultural households appears to be influencing household behavior regarding use of productive inputs. Our results thereby extend and expand the existing literature from a focus on intra-household allocation to farm level decision making. We believe this opens a wide avenue of opportunity for research and believe it would be instructive to examine the bias we uncover using data from more recent surveys and other sites and circumstances.

Policy prescriptions to issues raised here could include increasing education and awareness about gender roles and economic values, and inheritance laws associated with men and women. The results could also imply development of alternative technologies or occupations to cater specifically to the demand of women, such as micro-credit schemes. Development of women-oriented schemes would not only help female headed households but also alter perceptions regarding the economic value of girls versus boys.

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Table 1 Demographic characteristics of households, by village (1984)

% with	All villages	A	B	C	D	E	F	G	H	N obs
		Villages								
At least 1 girl	76	76	69	70	91	81	100	70	76	79
At least 1 boy	77	67	88	70	86	95	100	75	76	80
No boy	23	33	13	30	14	5	0	25	29	24
Only boys	24	24	31	30	9	19	0	30	24	25
Boy and girl	53	43	56	40	77	76	100	45	47	55
Household size	7.6	6.5	6.4	7.1	7.0	8.4	9.8	7.9	7.9	
N obs	104	21	32	20	22	21	5	20	17	

Note: observations are for 1984, except for villages B and D, which are for 1975.

Table 2 Cultivation and activity, by child gender (1984)

	At least 1 girl	At least 1 boy	No boy	Only boys	Boy & girl
Land Class (%)					
Landless	10.1	7.5	8.3	0.0	10.9
Small	21.5	26.3	16.7	32.0	23.6
Medium	27.9	30.0	25.0	32.0	29.1
Large	40.5	36.3	50.0	36.0	36.4
Cultivated area	9.3	8.7	9.1	7.6	9.3
Irrigated area (acres)	2.3	2.8	1.3	2.9	2.7
Field operations (%)					
Fertilizer	77.2	83.8	66.7	88.0	81.8
Manuring	51.9	55.0	54.2	64.0	50.9
Plant protection	25.3	26.3	16.7	20.0	29.1
Weeding	54.4	63.8	33.3	64.0	63.6
Harvesting	96.2	96.3	100.0	100.0	94.5
Interculturing	77.2	75.0	87.5	80.0	72.7
Resowing	13.9	10.0	12.5	0.0	14.5
Irrigation	68.4	73.8	58.3	76.0	72.7
Orchard	0.0	1.3	0.0	4.0	0.0
Nursery	10.1	13.8	28.2	20.0	10.9
Input use (kg/acre)					
Fertilizer	312.7	340.8	145.2	241.6	385.9
Manure	40.4	48.3	48.1	72.8	37.1
Insecticide	0.6	0.7	0.1	0.6	0.8
Pesticides	0.01	0.26	0.00	0.80	0.02
Average labor use (hours/year)					
Own animal	323.6	323.0	253.8	254.6	354.1
Family male	554.5	647.1	463.5	763.6	594.2
Family female	222.0	287.6	157.2	369.6	250.3
Family child	15.2	10.3	23.3	7.3	11.7
Hired male	375.6	417.8	299.3	437.3	408.9
Hired female	884.0	931.8	525.5	692.8	1040.4

Table 3 Input use intensity regressions

Variable	Fertilizer	Manure	Insecticide	Pesticide
No boy	20.76	10.47	0.04	-0.35
	(10.75)**	(3.72)*	(0.03)	(0.13)*
Boy & girl	22.18	9.36	0.06	-0.37
	(7.48)*	(2.90)*	(0.03)*	(0.19)**
Only boy	24.98	23.52	0.21	-0.673
	(9.31)*	(12.78)	(0.09)*	(0.31)*
Irrigated area	3.00	0.15	0.02	-0.04
	(0.59)*	(0.36)	(0.01)	(0.03)
Land value	-0.03	-0.01	-0.000	0.004
	(0.01)	(0.01)*	(0.00)	(0.00)*
F	42.70	19.25	7.39	44.94
N	657	657	657	657

In this and all following tables standard errors appear in parentheses.
* indicates significantly different from zero at 95% confidence level
** indicates significantly different from zero at 90% confidence level

Table 4 Input use intensity regressions, with village dummies

Variable	Fertilizer	Manure	Insecticide	Pesticide
No boy	63.030	24.477	0.094	1.254
	(6.77)*	(2.74)*	(0.05)	(0.48)*
Boy & girl	56.404	21.883	0.154	1.229
	(3.57)*	(3.85)*	(0.10)	(0.60)*
Only boy	61.473	32.936	0.205	0.863
	(4.60)*	(4.79)*	(0.18)	(0.75)
Irrigated area	2.350	-0.172	0.002	-0.019
	(0.57)*	(0.54)	(0.01)	(0.04)
Diploma	3.348	2.271	-0.003	-0.211
	(6.66)	(3.06)	(0.04)	(0.30)
Land value	-0.041	-0.016	0.000	0.004
	(0.02)*	(0.00)*	(0.00)	(0.00)*
Household size	0.635	0.381	-0.014	-0.035
	(0.95)	(0.33)	(0.01)	(0.03)
Village A	-54.517	-13.731	0.154	-1.431
	(4.63)*	(1.15)*	(0.03)*	(0.50)*
Village B	-4.616	0.296	0.026	-1.403
	(4.98)	(1.47)	(0.05)	(0.39)*
Village C	-55.250	-21.934	-0.077	-1.925
	(2.81)*	(0.83)*	(0.02)*	(0.37)*
Village D	-59.038	-20.905	-0.027	-1.758
	(3.18)*	(1.52)*	(0.02)	(0.35)*
Village E	-37.641	-22.244	0.154	-1.504
	(4.72)*	(0.99)*	(0.03)*	(0.51)*
Village F	-48.359	-22.591	-0.031	-1.052
	(5.49)*	(1.44)*	(0.03)	(0.69)
Village G	-19.442	-11.922	-0.074	-1.232
	(4.06)*	(1.36)*	(0.04)	(0.48)*
N	545	545	545	545

Table 5 Input use regressions, small land owners only

Variable	Fertilizer	Manure	Insecticide	Pesticide
No boy	33.249	14.812	0.095	-0.213
	(18.20)	(7.61)**	(0.04)*	0.20
Boy & girl	22.536	13.423	0.078	-0.122
	(10.40)*	(4.85)*	(0.04)	(0.12)
Only boy	20.224	29.105	0.405	-0.126
	(9.51)*	(15.28)**	(0.36)	(0.17)
Irrigated area	6.666	0.488	-0.028	0.038
	(4.19)	(1.57)	(0.03)	(0.08)
Land value	-0.070	-0.043	-0.000	0.002
	(0.04)*	(0.02)*	(0.00)	(0.00)
Diploma	-20.962	-11.838	-0.060	0.033
	(9.55)*	(4.23)*	(0.03)*	(0.04)
N	193	193	193	193

Table 6 Input use regressions, large and medium land owners

Variable	Fertilizer	Manure	Insecticide	Pesticide
No boy	22.16	8.77	0.05	-0.438
	(11.42)**	(2.99)*	(0.03)	(0.15)*
Boy & girl	24.15	6.57	0.10	-0.55
	(7.59)*	(1.95)*	(0.06)	(0.21)*
Only boy	38.52	14.42	0.03	-1.18
	(11.79)*	(5.80)*	(0.05)	(0.44)*
Irrigated area	2.61	0.37	0.01	-0.03
	(0.62)*	(0.14)*	(0.00)	(0.04)
Land value	-0.03	-0.01	0.000	0.01
	(0.01)*	(0.00)*	(0.00)	(0.00)*
Diploma	9.62	4.44	-0.07	-0.02
	(10.81)*	(6.19)	(0.04)	(0.24)
F	50.233	11.132	30.331	37.198
N	352	352	352	352

Table 7 Input use regressions, land values up to Rs. 5000 per acre

Variable	Fertilizer	Manure	Insecticide	Pesticide
No boy	9.464	-0.092	0.044	0.000
	(11.86)	(6.18)	(0.12)	(0.00)
Boy & girl	8.695	-1.395	0.011	0.000
	(11.25)	(6.79)	(0.08)	(0.00)
Only boy	11.471	20.534	0.447	0.000
	(6.21)	(8.26)*	(0.39)	(0.00)
Irrigated area	14.455	-0.561	-0.037	0.000
	(2.83)*	(2.79)	(0.04)	(0.00)
Land value	0.200	0.396	0.002	0.000
	(0.37)	(0.29)	(0.00)	(0.00)
Diploma	24.548	22.681	-0.000	0.000
	(24.36)	(26.35)	(0.07)	0.00
F	8.099	4.128	80.855	.
N	176	176	176	176

Table 8 Input use regressions, land values from Rs. 5001 to Rs. 21,200 per acre

Variable	Fertilizer	Manure	Insecticide	Pesticide
No boy	62.78	18.05	0.03	-0.13
	(29.92)*	(6.67)*	(0.04)	(0.12)
Boy & girl	51.15	13.54	0.09	-0.07
	(23.87)*	(5.39)*	(0.10)	(0.07)
Only boy	74.34	21.46	0.03	-0.12
	(31.16)*	(9.88)*	(0.05)	(0.11)
Irrigated area	5.72	1.27	0.04	0.02
	(2.98)**	(0.44)*	(0.04)	(0.03)
Land value	-0.28	-0.06	-0.00	0.001
	(0.16)	(0.04)	(0.00)	(0.00)
Diploma	-14.29	-8.06	-0.22	-0.15
	(22.04)	(3.16)*	(0.19)	(0.15)
F	6.960	11.289	6.115	17.099
N	185	185	185	185

Table 9 Input use regressions, land values from Rs. 21,201 to 292,100 per acre

Variable	Fertilizer	Manure	Insecticide	Pesticide
No boy	10.71	4.80	0.05	-1.34
	(10.56)	(3.71)	(0.06)	(0.37)*
Boy & girl	16.02	3.69	0.08	-1.54
	(8.97)	(2.15)	(0.11)	(0.36)*
Only boy	16.44	10.62	0.04	-2.23
	(8.74)	(8.00)	(0.09)	(0.63)*
Irrigated area	2.38	0.36	0.001	-0.020
	(0.42)*	(0.10)*	(0.00)	(0.05)
Land value	-0.01	-0.003	0.000	0.006
	(0.01)	(0.00)	(0.00)*	(0.00)*
Diploma	0.62	-0.25	-0.04	-0.22
	(7.78)	(1.68)	(0.04)	(0.37)
F	19969.62	207.41	150.21	187.84
N	184	184	184	184