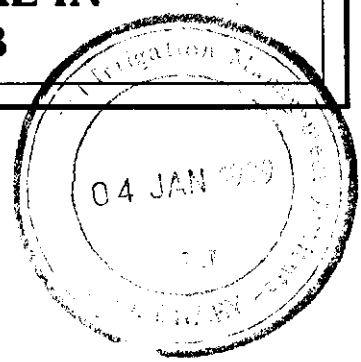
Report No. R-67

Managing Irrigation for Environmentally Sustainable Agriculture in Pakistan

A GENDER ANALYSIS OF CASUAL HIRED LABOR IN IRRIGATED AGRICULTURE IN THE PAKISTAN PUNJAB



CONTRIBUTION TO THE STUDY ON:
COLLECTIVE ACTION FOR WATER MANAGEMENT BELOW THE OUTLET

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TABLE OF CONTENTS

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1 INTRODUCTION

Gender[2] aspects of irrigation and drainage is a field that is getting more and more attention these days[3]. This paper discusses some issues related to the use of casual hired labor in the Pakistan Punjab, with special reference to gender aspects.

Casual hired labor is an important factor in cash crop production in irrigated agriculture in the cotton-wheat belts. Some of these agricultural tasks are exclusively done by men, while other tasks are mainly done by female laborers.

This paper focuses on the contribution of women in agricultural labor. It does not extensively discuss issues such as the organization of agricultural labor or the income that male and female laborers get. It will suffice to say that their livelihood depends on these sources of income. It is worthwhile to remark, though, that agricultural wage laborers are 'the poor' in terms of access to resources. Oftentimes, the only resource they have is their own labor. Rural development programs that aim to improve the living conditions of 'the poor' should take into consideration this crucial role, but at the same time, the vulnerable position of this group.

The next section discusses the research methodology. In Section 3, the main research findings are presented. The main conclusions are given in Section 4. Section 5 contains the main recommendation.

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[1] The author was an Associate Expert with IIMI-Pakistan from July 1995 till December 1997. She acknowledges the contribution of Annemiek Terpstra and Arjen During and wishes to thank them for their comments on the paper.

[2] 'Gender' refers to socially constructed and determined characteristics, roles, ideas, values, beliefs, etc., which are attributed to men and women by a particular society. Gender issue is an anomaly / discrepancy / problem that arises and affects an individual on the basis of their sex (definitions are taken from a training course on gender in Kenya, personal communication Silvie Walraven).

[3] In Pakistan, the International Irrigation Management Institute (IIMI) has recently launched a program on gender and irrigation, and the International Waterlogging and Salinity Research Institute (IWASRI) pays attention to the role of women in drainage in pilot areas in the Pakistan Punjab.

2 RESEARCH METHODOLOGY

2.1 Site Selection

Fieldwork was conducted in six sample watercourses of Hakra 6-R Distributary under the project on 'Collective Action for Water Management below the Outlet'[4] from July '96 to September '97. The map in Annex 1 shows the location of Hakra 6-R Distributary in Pakistan and in Fordwah Eastern Sadiqia (South) Irrigation and Drainage Project.

As some information on sixteen watercourses was already available from earlier fieldwork by IIMI, six watercourses could be selected that differed significantly in physical and social characteristics. In Table 1, some of the features of the sample watercourses are mentioned. Map 2 in Annex 1 depicts the sample watercourses within the command area of Hakra 6-R.

Table 1. Particulars of sample watercourses.

Characteristic	7-L[a)]	10-R	45-L	61-L	101-R	117-R	Total
Number of cultivators	31	64	64	30	23	33	245
Design CCA[b)] in acres[c)]	331	618	467	556	275	451	2698

[a)] The number stands for the Reduced Distance (RD) from the head of the distributary. 1 Rd = 1000 feet. L indicates that the watercourse off-takes on the left bank of the distributary and R refers to the right bank.
[b)] Culturable Command Area.
[c)] 1 acre = 0.4 hectare.

2.2 Casual Hired Labor

In October '96, a survey was conducted among all the actual cultivators of the sample watercourses (i.e. owner-cultivators, tenants and contractors). The objective of the survey was to collect basic social, economic and agronomic information about these farm households. In total, 245 cultivators were interviewed by a survey-team of four persons. The survey questionnaire contained one question on casual hired labor. This question is displayed in Annex 2.

During a field trip in November 1998, some women that were picking cotton in the fields of 10-R and 101-R watercourses were interviewed.

2.3 Waterlogging and Salinity

One aspect of the overall study was to estimate the influence of the condition of the land on collective action for water management. For this purpose, information was collected on waterlogging and salinity. Waterlogging and salinity, which are mainly the result of a rising groundwater table and the absence of a proper functioning drainage infrastructure, are considered

[4] The objective of this study was to find the socio-cultural and technical factors that influence the potential among farmers to undertake collective action for water management. This study was part of the Dutch funded project on 'Managing Irrigation for Environmentally Sustainable Agriculture'.

a serious threat to Pakistan's agricultural sector[5]. Information was collected through focused group interviews and mapping exercises with farmers. A more detailed description of the methodology is given in Annex 3a. The IIMI staff could easily crosscheck the information, collected in this way, on their regular visits to the field. This method of data collection proved to give very accurate information and was time saving[6].

2.4 Cropping Pattern

Cropping patterns in *Rabi* '96 and *Kharif* '97[7] were collected from the Punjab Irrigation Department (PID) staff. IIMI field staff also completed crop surveys in two of the sample watercourses (7-L and 10-R). A comparison of the PID crop census with IIMI's census showed great similarity. The crop census of these two watercourses could thus be fully checked and these data are therefore considered very accurate. For the four remaining watercourses, reliance was placed on the PID information. Here it should be noted that these watercourses came under different *patwaris*[8] and not much can be said about their accuracy. However, the IIMI field staff could crosscheck much of the PID information on their daily visits to the field. The first impression was that the information provided to IIMI by the PID *patwaris* and *zilledars*[9] does not differ much from the actual cropping patterns. Although information on cultivated crops was also collected in the earlier mentioned survey for *Kharif* '96, these two data sets (one based on information provided by PID and one by farmers) have so far not yet been compared. It is known that some *patwaris* are bribed by farmers for noting down crops, for which less *abiana*[10] has to be paid[11]

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[5] It is estimated that soil salinity deprives Pakistan of about 25 percent of its potential production of major crops (Pakistan Irrigation and Drainage: Issues and Options. World Bank Report No. 11884-PAK, 1994).

[6] This method was derived from a data collection method earlier developed by IIMI-Pakistan but not further applied in the field (N. Kielen. Farmers' perceptions on salinity and sodicity: a case study into farmers' knowledge of salinity and sodicity, and their strategies and practices to deal with salinity and sodicity in their farming systems. IIMI Pakistan Report No. R-3. 1996).

[7] *Rabi* is the winter season, which lasts from October to April. The main *Rabi* crop is wheat. The summer season is called *Kharif* and lasts from April to October.

[8] A *patwari* is a revenue official at the field level for a particular *patwar* circle, keeper of revenue and warabandi schedules record, surveyor of crops, etc. (D.J. Bandaragoda and Saeed ur Rehman. Warabandi in Pakistan's canal irrigation system: widening gap between theory and practice. IIMI Country Paper, Pakistan No.7. Colombo, Sri Lanka: IIMI. 1995).

[9] A *zilledar* is a junior member of supervisory staff of revenue establishment of the Irrigation Department, supervising a number of *patwar* circles (D.J. Bandaragoda and Saeed ur Rehman, 1995).

[10] *Abiana* means water charges.

[11] As far as our knowledge goes, only one *patwari* (out of three) favored some of the cultivators of his working area by noting down a different crop or 'no crop', in order to decrease the amount of *abiana* to be paid by the cultivator to the PID.

3 PRESENTATION OF FIELD DATA

3.1 Waterlogging and Salinity

For each of the sample watercourses, the percentage of culturable command area (CCA) that is affected by either waterlogging or salinity, or both, is displayed in Table 2.

Table 2. Waterlogging and salinity in sample watercourses.

	7-L	10-R	45-L	61-L	101-R	117-R
Area affected by waterlogging and/or salinity (% of total CCA)	79	15	96	84	11	4

Table 2 shows that the watercourses located on the left side of the main distributary (7-L, 45-L and 61-L) have more serious problems with waterlogging and salinity than watercourses off-taking on the right bank of Hakra 6-R main distributary. One possible explanation could be the elevation of the land. The command area maps of Hakra 6-R Distributary, that were made available to IIMI by the PID Circle Office, Bahawalnagar, showed that the commanded areas of the watercourses on the left side of the distributary were less elevated than those on the right side.

In the beginning of the nineties, a surface drainage system was constructed (under the Command Water Management Project) to serve the entire command area of Hakra 6-R Distributary. Farmers' interviews and field observations, however, made it very clear that this drainage system was never fully completed and is presently not functioning properly in any part of this distributary command area. Thus, absence of a drainage infrastructure could explain problems of waterlogging and salinity, while the diversity in the severity of waterlogging and salinity in the different watercourses might be due to differences in field elevations.

'Salinity maps', showing the type and extent of salinity and waterlogging, are displayed in Annex 3b.

3.2 Cropping Pattern

In this area, the main *Rabi* crop is wheat, while the main *Kharif* crop is cotton. Crops that are cultivated on a much smaller scale are fodder crops, oilseed, sugarcane, rice, vegetables, as well as orchards. The area under cotton and wheat is given in Table 3. It should be noted that although the acreage under cotton varies from 34 to 76% of the total cultivated land in *Kharif*, practically all cultivators have at least a part of their land under cotton cultivation.

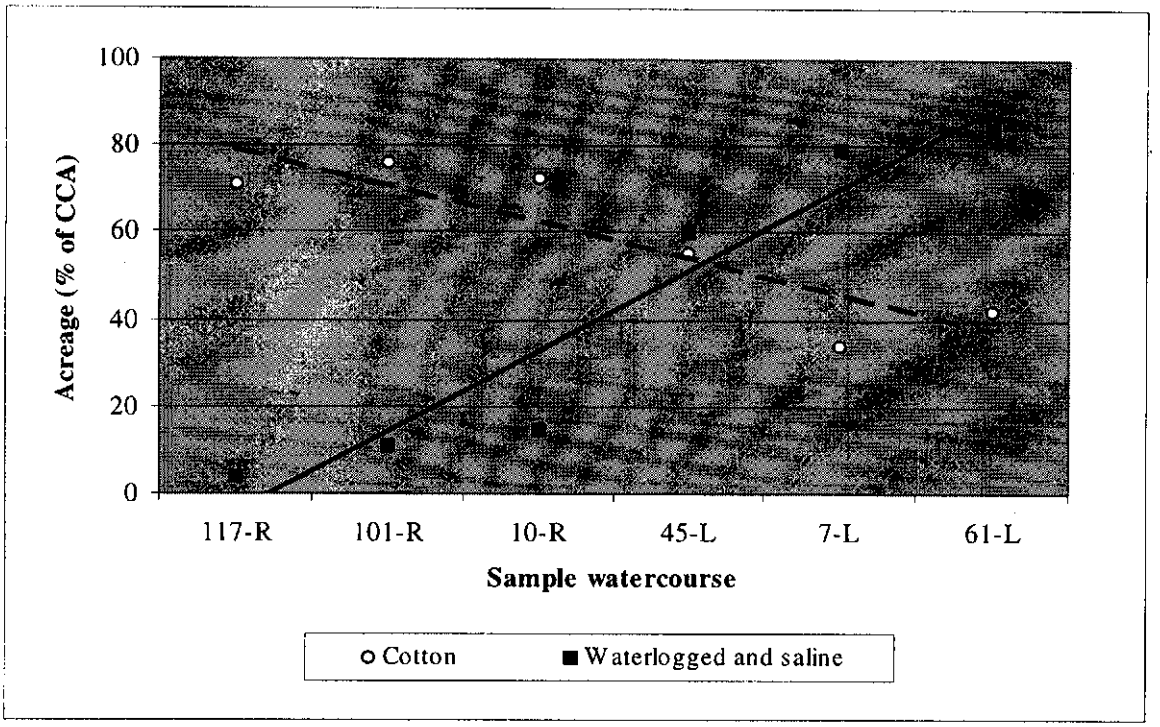
Table 3. Main crops in sample watercourses.

Cropped area (% of CCA)	7-L	10-R	45-L	61-L	101-R	117-R
Cotton in *Kharif*	34	72	55	42	76	71
Wheat in *Rabi*	80	84	73	62	81	89

The acreage under wheat in the sample watercourses is less divergent than the area under the cotton crop. Still, the acreage under wheat is slightly less in the watercourses on the left side of the distributary.

There is a strong negative correlation between the acreage of land affected by waterlogging and salinity and the area under cotton cultivation. Though it is somewhat 'misleading' to give the 'statistical error' of the analysis, as the values per se are already averages of the entire watercourse, it is worthwhile mentioning that the correlation coefficient of the two data sets shows a very clear negative correlation between waterlogging and salinity and cotton (-0.96). The relation is visualized in Figure 1.

Figure 1. Correlation between salinity and area under cotton.



3.3 Use of Casual Hired Labor

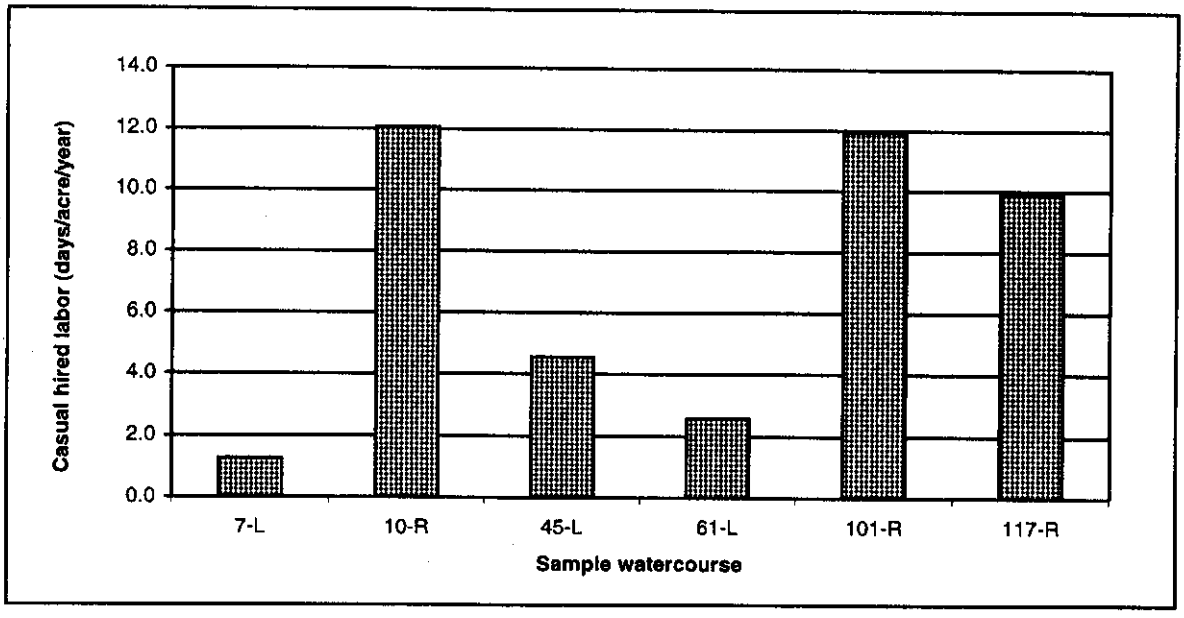
Respondents were asked whether they make use of casual hired labor during the agricultural year. The percentages of farmers, who do make use of hired labor, are given in Table 4. The majority of the actual cultivators make use of casual hired labor. In the watercourses with less waterlogging and salinity, relatively more cultivators stated that they use casual hired labor. Tenancy status has no significant influence on whether or not to hire casual labor (i.e. owner-cultivators, tenants and contractors all hire casual labor).

Table 4. Incidence of casual hired labor in sample watercourses.

	7-L	10-R	45-L	61-L	101-R	117-R
Cultivators making use of casual hired labor (%)	45	94	66	80	100	97

The amount of casual hired labor in days/acre/year is displayed in Figure 2. The figure shows that relatively the lowest amount of casual labor is hired in 7-L watercourse (1.3 days per acre of CCA per year) and the highest in 10-R watercourse (12.1 days).

Figure 2. Use of casual hired labor in sample watercourses.



With regard to the amount of casual labor hired, there seems to be a clear distinction between watercourses that suffer from waterlogging and salinity and watercourses that do not. The correlation coefficient between the two data sets (days/acre/year of casual hired labor and area affected by waterlogging and salinity) is –0.96 (see Table 5).

Table 5. Correlation between waterlogging / salinity and casual hired labor.

	7-L	10-R	45-L	61-L	101-R	117-R	
Area affected by waterlogging and salinity	0.79	0.15	0.60	0.84	0.11	0.04	
Casual hired labor per acre of CCA (in days/year)	1.3	12.1	4.5	2.6	11.9	9.9	Corr.coeff. -0.958845

Furthermore, it is worthwhile mentioning that villages belonging to watercourses with much waterlogging and salinity show out-migration of (male and female) agricultural laborers, while the other watercourses have in-migration of laborers and tenants[12].

Cultivators hire labor for numerous activities related to crop cultivation and in only a few cases for water management. Table 6 gives an overview.[13]

Table 6. Activities performed by casual hired laborers.[a)]

Activity		7-L	10-R	45-L	61-L	101-R	117-R	Total
Wheat	Sowing				1			1
	Harvesting	6	42	20	13	16	14	111
	Threshing	6	46	17	16	17	15	117
Cotton	Hoeing	1	13	4	6	10	6	40
	Spraying		13	3	1	5	6	28
	Picking	5	52	20	10	19	31	137
Rice planting		1			4			5
Sugarcane	Sowing		1	3	1			5
	Hoeing		1					1
	Cutting						1	1
Plowing with tractor		7	30	27	10	5	4	83
Applying farmyard manure		3	11	1	1	1	2	19
Combine harvesting			1					1
Sowing with tractor		1						1
Repairing the watercourse			1					1
Desilting the watercourse				1				1
Water turn						1		1
Total number of cultivators in watercourse		31	64	64	30	23	33	N=245

[a)] The numbers in the table refer to the number of cultivators that hire casual labor to perform (part of) this activity.

[12] In the survey of October '96, (see Section 2.2) respondents were asked about the main changes in their village and who are the persons responsible for, or involved in, this change. In watercourse 7-L, 35% of the cultivators mentioned out-migration of agricultural laborers and tenants. In watercourse 45-L it was 34% and in watercourse 61-L 70% mentioned migration of poor laborers and tenants out of the village. In watercourse 10-R, nine of out the 64 cultivators mentioned that one of the changes in their village was in-migration of poor laborers and tenants from waterlogged areas. (The government, through an allotment scheme, promoted this development.) In watercourse 101-R, 50% of the cultivators mentioned in-migration of poor families and laborers as one of the developments in their village. In watercourse 117-R, four out of 33 shareholders mention in-migration of landless families and tenants. Four other cultivators said there is in-migration of skilled agricultural laborers. (See Fayyaz Ahmad Ch. and Cris H. de Klein, Social Characteristics of six sample watercourses and their related villages: survey analysis PART1 (draft), IIMI-Pakistan, June 1997.)

[13] Cultivators whose crop is largely damaged by waterlogging (e.g. in 7-L watercourse), mentioned that they performed some of the tasks, which they otherwise would have farmed out to laborers, themselves.

Harvesting and threshing wheat and picking cotton are the activities mentioned most by the cultivators. More than half of the cultivators hire labor for cotton picking. The division of time among the different activities differs for each watercourse. The crop-wise casual hired labor input is displayed in Table 7.

Table 7. Labor input per crop during the agricultural year.

Crop	7-L	10-R	45-L	61-L	101-R	117-R
Wheat	71	36	46	48	36	14
Cotton[a)]	17	58	43	42	61	81
Rice	7	0	0	4	0	0
Sugarcane	0	0	2	4	0	3
General/other[b)]	5	5	10	2	3	2
	100	100	100	100	100	100

[a)] Since the survey was conducted at the time of picking the cotton, many cultivators mentioned only the amount of hired labor invested so far (after one or two pickings) instead of mentioning the amount of labor hired during an average agricultural year. This became clear after the survey had been conducted and could not be corrected later on. Therefore, it may be assumed that the total amount of labor hired for cotton picking till the end of the season is higher than given in this figure (and in the rest of this paper). This counts mainly for the watercourses on the right side of the distributary, since most of the cotton crop in the other watercourses was damaged.

[b)] General/other includes: plowing with tractor, applying farmyard manure, combine harvesting, sowing with tractor, repairing the watercourse, desilting the watercourse and arranging the water turn.

The cultivators of watercourses on the left side of the distributary hire more labor for their wheat crop than for cotton. Hiring labor for cotton production prevails in the other three watercourses. This can be explained by the fact that in the latter category of watercourses, more cotton is cultivated, but also because of the high cotton crop damage in the waterlogged watercourse command areas. Whereas many of the cultivators in 10-R, 101-R and 117-R mention that their cotton in *Kharif* '96 was (partly) affected by a virus, the cultivators of 7-L, 45-L and 61-L almost without exception talked about severe damage of their cotton crop by waterlogging, often caused by severe rains.

3.4 Gender Aspects of Casual Hired Labor

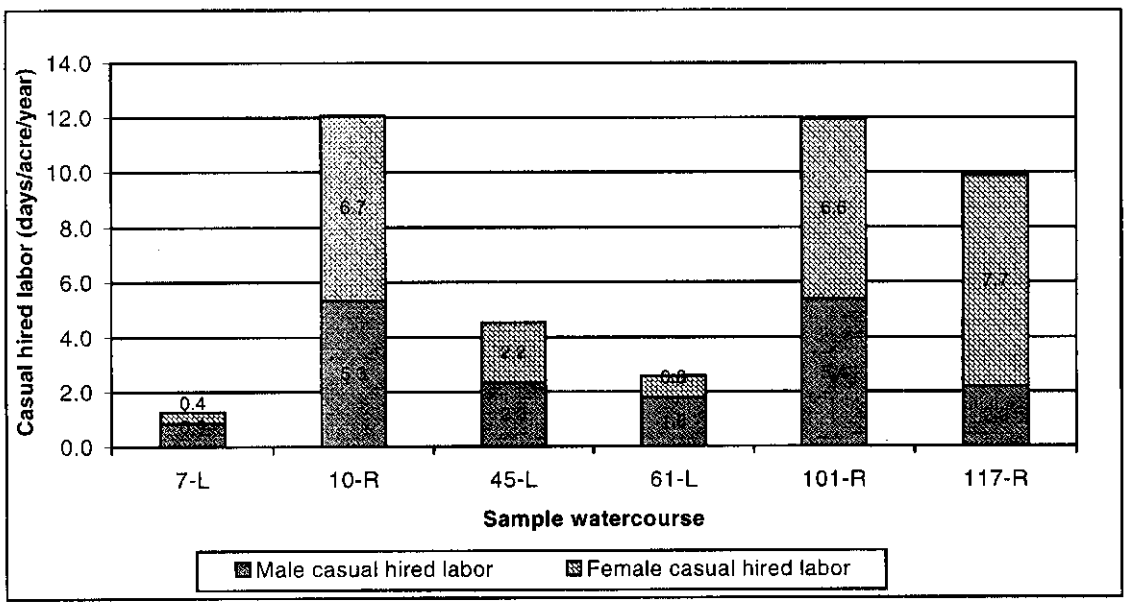
In the large-scale gravity irrigation system in the Pakistan Punjab, women do not play a role as irrigators. However, they perform many agricultural tasks within the farm household, such as feeding the cattle and weeding and harvesting vegetables.

Furthermore, women work as agricultural laborers. These are not women from landowning families, but from laborer castes. Since the overall research was about (social and physical factors that influence) collective action for irrigation management, the main focus was on actors other than the agricultural laborers. These agricultural laborers were not formally interviewed. Therefore, not much can be said about the cultural values of these groups of laborers. However, observations and discussions in the field and villages, make clear that laborers belong to the minority groups in the social stratification of the rural Punjab. In general, the women of these

groups (unlike those of many of the landowning families) do not observe *purdah*[14] (i.e. they are not completely veiled), they are not bound to stay inside the house, and work outside the house (e.g. on someone else's fields).

On the basis of an agricultural year, the total number of working days (for all activities performed) of male laborers in the six sample watercourses amounts 8149, while female casual hired laborers record 11028 days. A task, for which mainly female laborers are hired, is picking cotton. With a few exceptions, this task is done exclusively by women and girls. In only a few cases, cultivators hired only men for this task[15]. Other tasks that female casual hired laborers do are harvesting wheat and planting rice. In all of the other tasks, women are not involved. It looks to be, that these are mainly tasks for which machinery is used (such as plowing with tractor, spraying, wheat threshing). Water management activities (though mentioned by only a few cultivators) are also not performed by women. Other tasks that female laborers do not do are applying farmyard manure, hoeing cotton, sowing wheat, and sowing and cutting sugarcane. In Figure 3, the contribution of male and female laborers is given per watercourse.

Figure 3. Use of male and female casual hired labor.



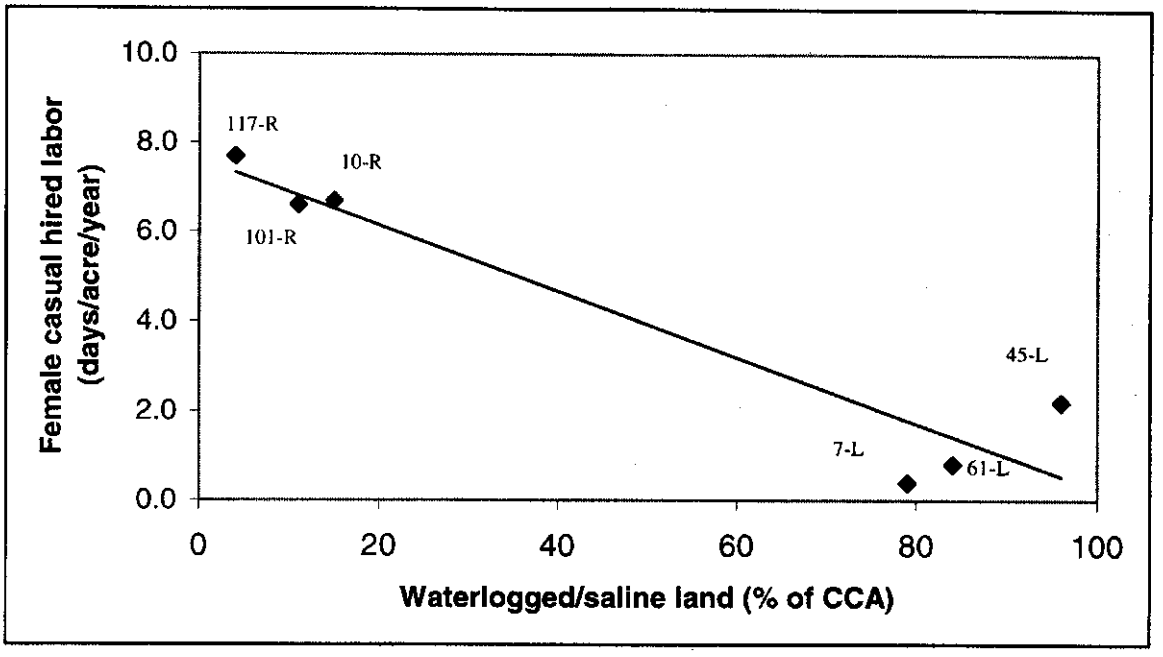
There is a strong correlation between the number of working days/acre/year of female laborers, and the extent of waterlogging and salinity (-0.99). The correlation is visualized in Figure 4. This figure also shows that there are two clear groups:

[14] '*Purdah*' literally means curtain. It is used as a means to hide women from the view of men who do not belong to the family. Not only the veil, but also the entire protected situation of women can be referred to as '*purdah*'.

[15] In searching for reasons why these cultivators (6 in total, spread over 5 watercourses) hired only men for picking cotton, a few possible variables were checked. Caste seems to be of no influence. It was noted, however, that five of these cultivators had a more than average education status.

- Watercourses with a low percentage of land under waterlogging and salinity. In these watercourses, a lot of female labor is hired. These are the watercourses on the right side of the distributary (10-R, 101-R and 117-R);
- Watercourses with a high percentage of land under waterlogging and salinity. In these watercourses, the use of female casual hired labor is low or negligible. These are the watercourses on the left side of the distributary (7-L, 45-L and 61-L).

Figure 4. Condition of the land and role of women in casual hired labor.



What are the prospects for both male and female laborers to find employment during the *Kharif* and *Rabi* seasons? Let us have a look at the contribution of male and female laborers to the main crops of these seasons: cotton and wheat.[16]

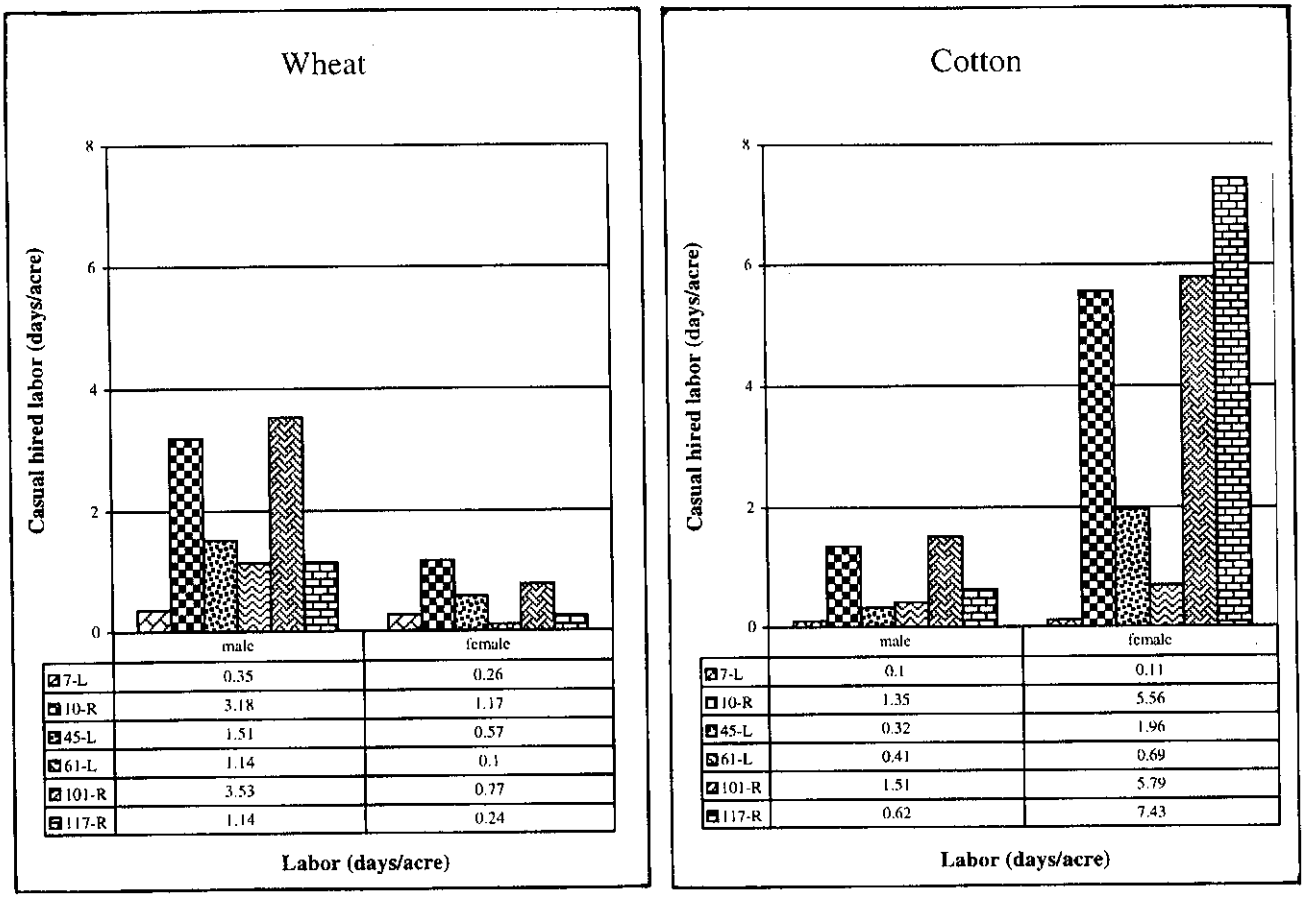
Figure 5 shows that most of the hired labor is used for the cotton crop and female laborers provide most of this labor. Especially the watercourses where waterlogging and salinity is low (10-R, 101-R and 117-R), the input of women is high. One can imagine, by looking at the figure, how the input of female casual hired labor would be reduced if the soil quality would be the same as in the watercourses on the left side of the distributary. The female labor input for cotton in these (left-side) watercourses is almost nil, or very low. From this, the conclusion can be stated, that women lose labor opportunities and thus an important source of income, when there is no, or hardly any, cotton production.

With regard to wheat, women play a less important role than men. However, in case of wheat, the loss of labor for women is not so high in the saline and waterlogged watercourses as it is in the

[16] From Table 7, it can be seen that wheat and cotton are by far the main crops in which agricultural laborers can find employment (89 to 99% of the total labor input per watercourse). Therefore, crops other than cotton and wheat are not considered here.

case of cotton. The figure shows that there is less work in wheat for male laborers in the waterlogged and saline watercourses than in the watercourses with a good soil quality. However, in relative and absolute terms, in waterlogged and saline watercourses, male agricultural laborers lose less in wheat than women do in cotton.

Figure 5. Male and female casual hired labor for cotton and wheat in sample watercourses.



The harvesting of cotton starts towards the end of September and ends in the beginning of December. This period is so stretched, because the cotton is harvested in a series of subsequent pickings and because fields are not sown at the same time. Some female laborers that were interviewed in watercourse 101-R said that they pick cotton for three months continuously[17].

A laborer is paid on the basis of amount of cotton she picks during the day. This depends mainly on the status of the crop. One *maund* (i.e. 40 kg) of cotton pays around 70 Rupees. Sometimes it

[17] It has been reported that female laborers plan the timing of cotton picking in such a way that they manage to get higher income out of it. They do this by extending the period between cotton pickings, so that more cotton can be picked. Landowners are dependent on that, and it seems that often they have no choice but to postpone the sowing of the wheat (*rabi* crop) to a later date then they actually prefer (D. Meerbach, IIMI-Pakistan 1996, personal communication). Keeping in view the fact that women work on an individual basis and that, thus, the composition of the groups of recruited laborers change continuously, it would be interesting to know how women can (collectively) have influence on cotton cultivators.

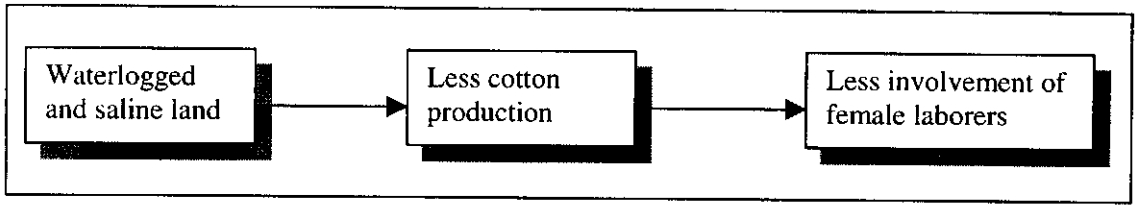
is possible to pick one *maund* of cotton in a day. If there is a lot of cotton on the crop, one can earn as much as 80 to 100 Rupees per day. The average, however, is around 60 Rupees per day. Though these data are based on just a few informal talks with cotton pickers, a rough indication of the income of female casual hired laborers would be: 90 days * 60 Rupees/day = 5400 Rupees during the season.

4 MAIN CONCLUSIONS

There is a considerable difference in amount of casual labor hired (expressed in days/acre/year) in the sample watercourses. In watercourse command areas that are not, or hardly, affected by waterlogging and salinity, more casual labor in hired. These areas are suitable for cotton production, a crop that demands high labor input during the harvest.

The field data in six sample watercourses in Hakra 6-R Distributary show that the role of women as casual hired laborers largely depends on the type of crops cultivated. This, in turn, depends on the quality of the soil. In waterlogged and saline areas, there is less cultivation of cotton and, therefore, less involvement of female laborers. This relation is represented in Figure 5.

Figure 5. Relation between quality of land and involvement of women in irrigated agriculture.



5 RECOMMENDATION

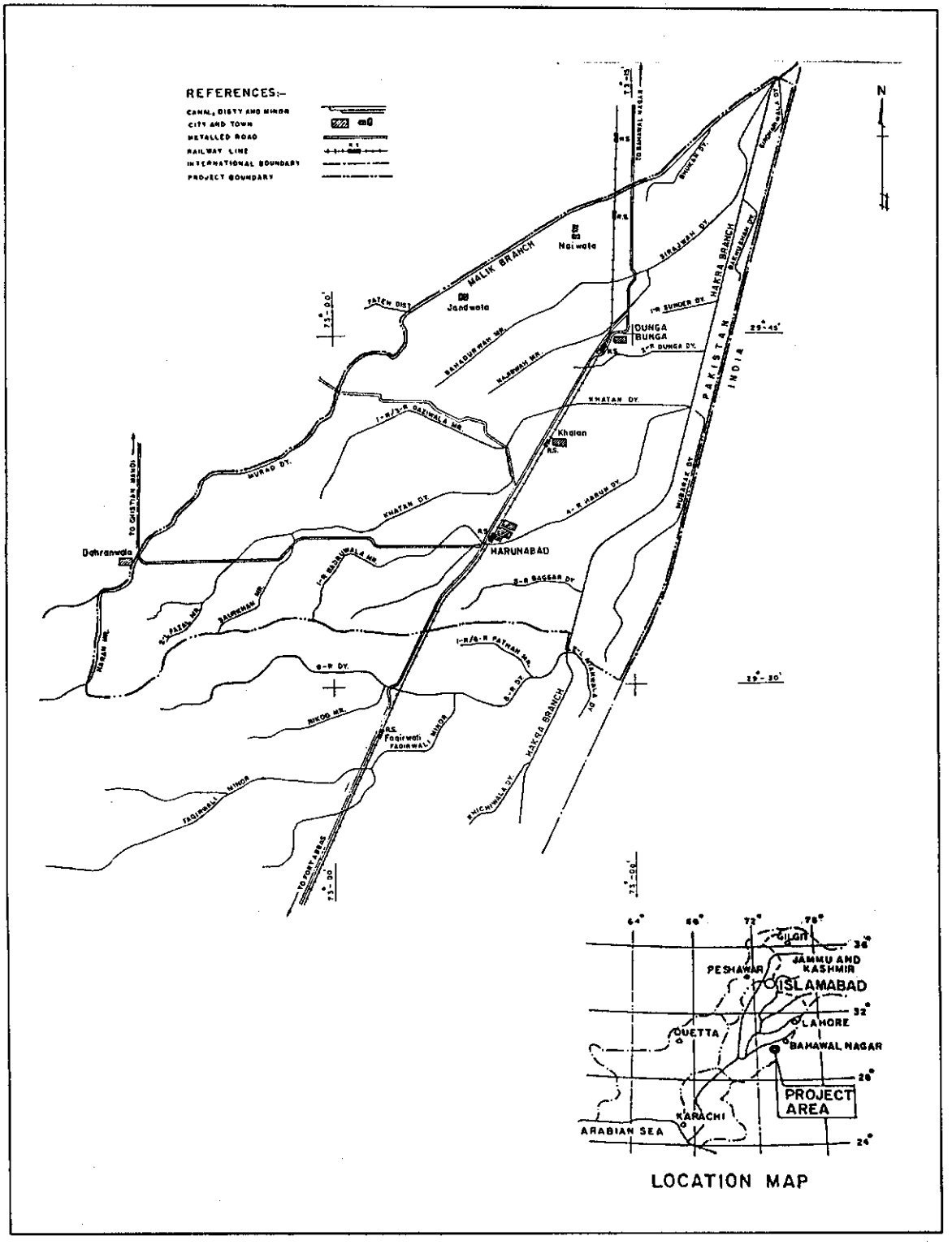
The role of casual hired labor is indispensable for irrigated agriculture. This is especially the case with cotton, which is the most profitable crop[18]. Cotton production is not only remunerative for the cultivators (or landowners), but also for the female agricultural laborers.

Since the possibilities for cotton cultivation mainly depend on the condition of the soil, degeneration of the soil in terms of waterlogging and salinity should be halted. In this way, a source of income for women from the lower income groups will be guaranteed.

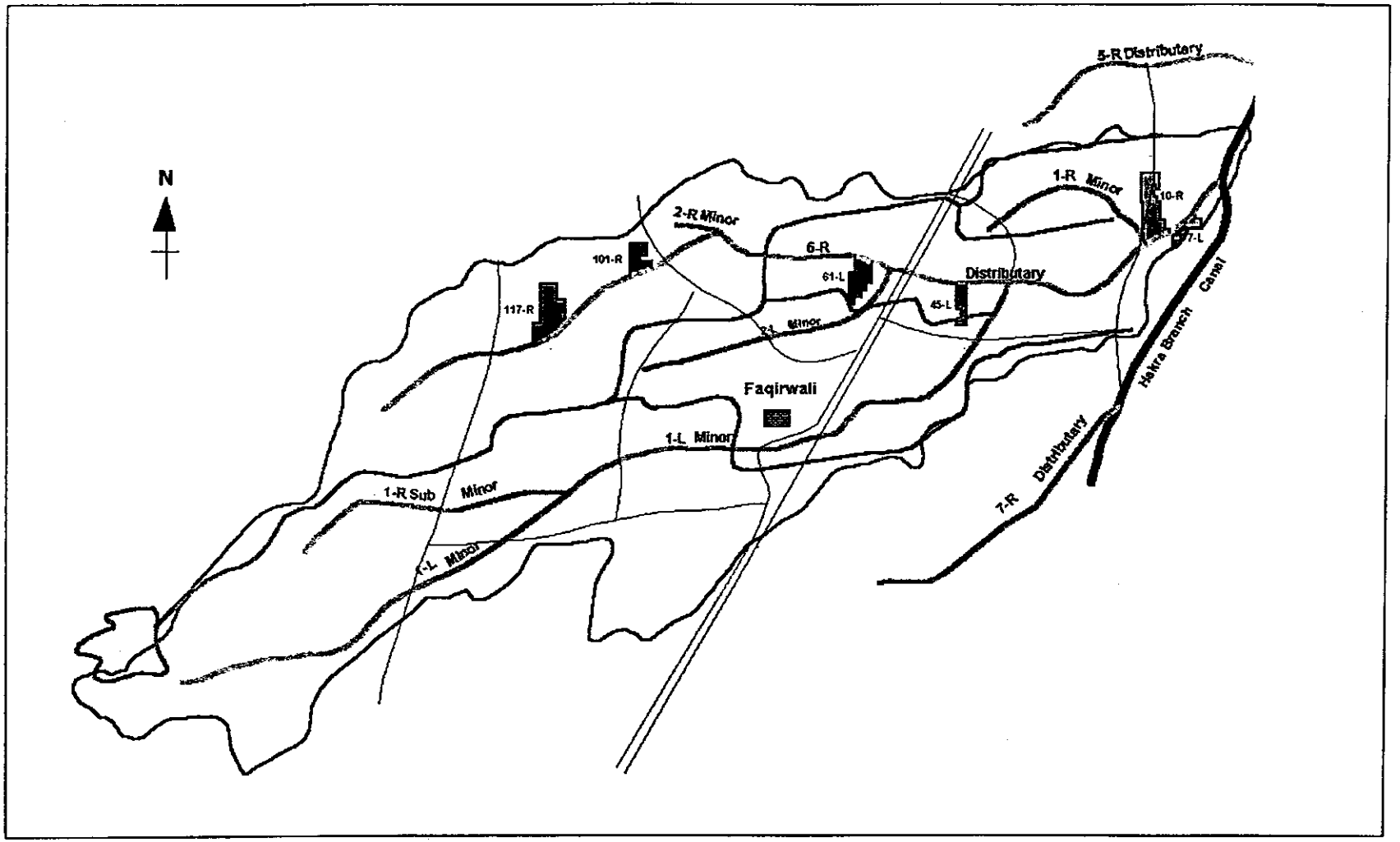
[18] In the sample watercourses cotton is considered a profitable crop. If the water availability increases, farmers prefer to switch over to sugar cane and rice.

ANNEX 1: MAPS

Map 1: Location of Hakra 6-R Distributary in Pakistan and FES(S) project area.



Map 2: Location of sample watercourses within the command area of Hakra 6-R Distributary.



ANNEX 2: SURVEY QUESTIONNAIRE

Concerned question from Survey questionnaire on 'Social Characteristics of Sample Watercourses and Villages in Hakra 6-R Distributary', *Kharif* 1996.

4.9 In an average agricultural year, do you hire casual labor? [yes/no]

For which tasks casual labor is hired? (see table)

Task	Male (number of days and number of persons)	Female (number of days and number of persons)	Total
1			
2			
3			
4			
5			
6			

ANNEX 3: SALINITY MAPPING

Annex 3a: Description of the research methodology

For the study on 'collective action for water management below the outlet' information was required on the status of waterlogging and salinity in the command areas of the sample watercourses. Initially, IIMI field staff started collecting this information themselves by observing the fields in the entire watercourse command areas. This, however, required a lot of time, which the staff did not have. Therefore, it was decided to use a different method to collect this data. The method chosen was 'salinity mapping with farmers'. This method was derived from a study that was done earlier by IIMI-Pakistan (Kielen, 1996). That study tried to link up scientific definitions and meanings of salinity and sodicity with farmers' definitions and perceptions. As the field assistant who was at that time involved in that study, was now working in the command area of Hakra 6-R, basic knowledge of the method was present within the field team.

The method was first tried in one watercourse command area and - after discussion within the team - further modified and applied in all the six watercourses.

In each of the six sample watercourse command areas, meetings were organized with farmers. In order to get sufficient detailed information on the entire command area at least two meetings per command area were planned, each with farmers knowing more about a specific reach of the watercourse. In some cases separate meetings had to be organized because of disturbed social relations within the farming community.

It was tried to gather those farmers, who were known to the field staff and to other farmers as being knowledgeable about the lands of the watercourse. Mostly, these farmers also had the following characteristics: actual cultivator, aged and having contacts with many of the other cultivators. The number of participants in each meeting varied, depending on the number of knowledgeable people that could be found, people interested, size of the command area to be discussed and number of cultivators in that command area.

At least 2 members of the field team conducted the meetings. One acted as facilitator, one as note-keeper and in case a third one was present, he was observer. Materials used were: large copy of the map of the watercourse command area (prepared earlier by the field team), showing *killas* and squares[19], and colored markers.

Each meeting started with a short introduction by the facilitator about the objective of this meeting. More explanation was in most cases not needed, as introduction meetings in all villages had been conducted in the beginning of the research. Farmers were asked to tell about the presence of salinity and/or waterlogging in each *killa*. From the earlier study mentioned above, it was known that farmers divide salinity in different classes, such as white salinity, black salinity, white salinity that consists of powder, white salinity with a crust on it, etc. The farmers in our sample watercourses used a similar type of categorization. They used percentages to refer to the extent to which the soil was affected by salinity. Firstly, this percentage refers to the acreage of the *killa* under saline or waterlogged land. Moreover, it refers to the severity of salinity (this

[19] One square consists of 25 *killas*. One *killa* is one acre, and is 198 by 220 feet. One *killa* is again divided in eight *kanal* and one *kanal* consists of 20 *marla*.

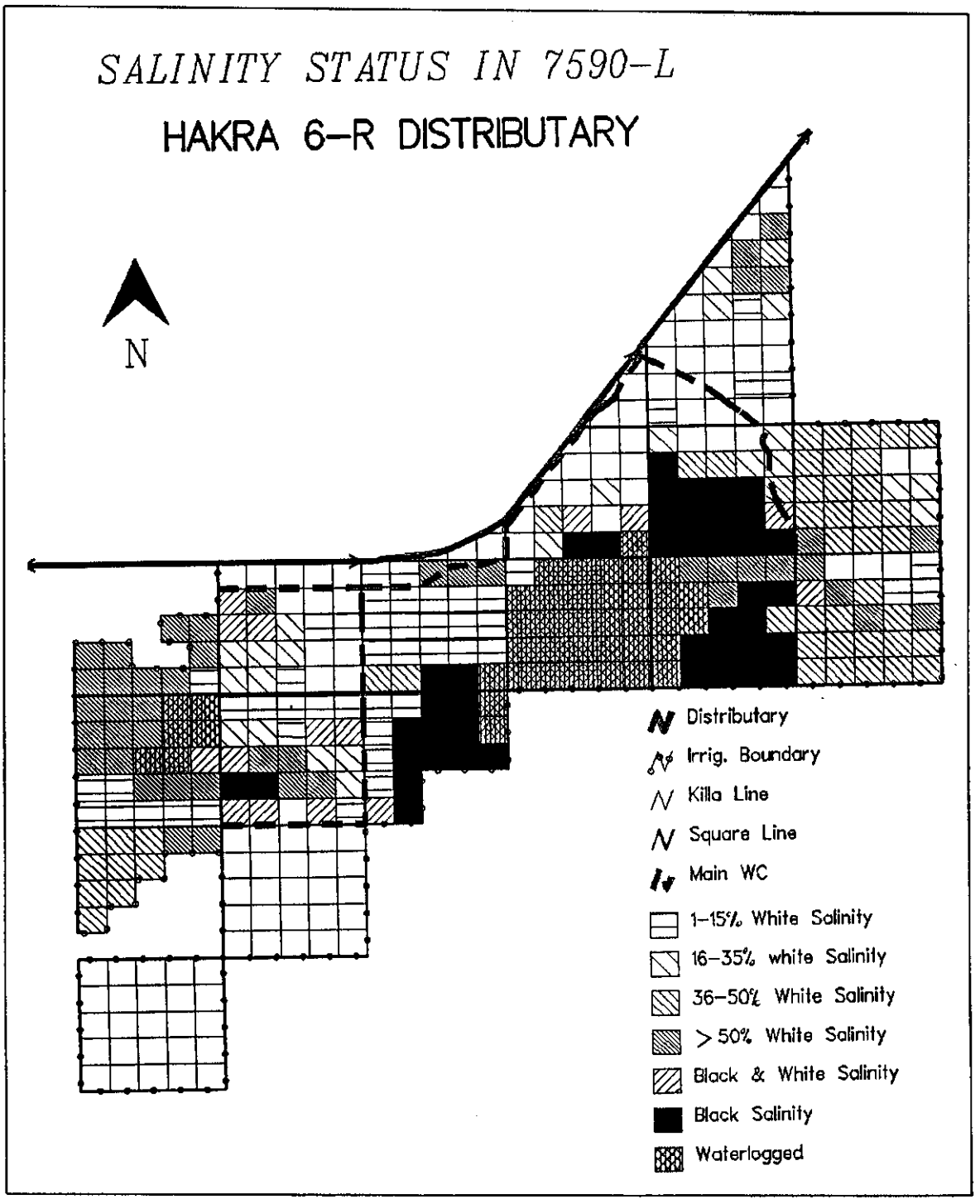
might be the only disadvantage of this method). The higher the percentage, the higher the chance that crop production is not possible anymore or that standing crop is at least affected.

The way farmers perceive salinity on their land is partly, of course, subjective. This method proved to offer possibilities to crosscheck farmers information and to ensure that the information given was standardized. Farmers from the same watercourse were continuously asked to compare the field they were talking about with the field that was already discussed, and asked 'is it the same, is it worse or better, what are the differences?' The field staff could observe the fields. When moving to other watercourses, the field team was able to explain to farmers in the meeting there, what exactly other farmers meant by a certain category of salinity. For example with regard to the acreage under salinity, the type of salinity, whether or not a crop could still be grown on the field and the condition of the standing crop.

Data were then entered in the computer (Foxpro) and mapped, using Arcinfo. Though information was available below the *killa* level, with the present set-up of the software it was not possible to display information on a more detailed level than the *killa*.

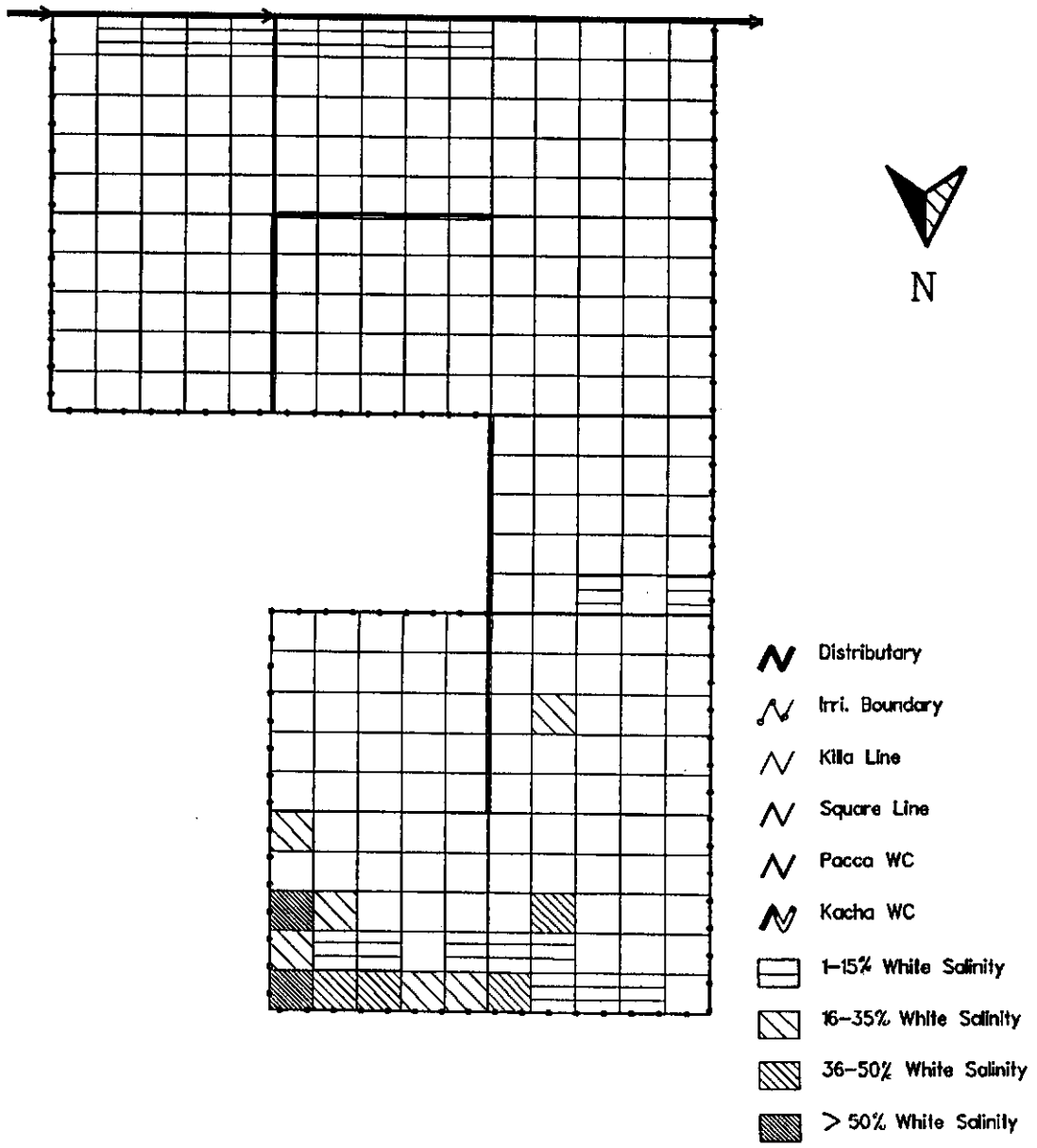
Annex 3b: Salinity maps

Hereunder salinity maps of two of the watercourse command areas are displayed. These maps are a computerized version of the maps that were made by IIMI field staff in collaboration with the farmers. For this annex, one map of a waterlogged and saline watercourse was selected, and one map of a watercourse command area with hardly any salinity.



SALINITY STATUS IN 100714-R

HAKRA 6-R DISTRIBUTARY



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