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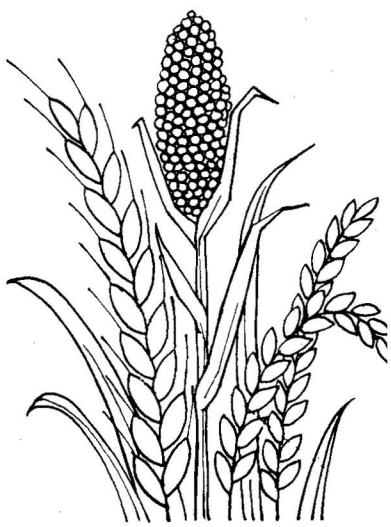

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A COMPARATIVE ANALYSIS OF DRY AND IRRIGATED FARMING IN FEROZEPUR DISTRICT, PUNJAB

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In India, dry farming is practised on approximately 80 per cent of the total cropped area. This area contributes roughly 42 per cent of the nation's total food production. The recent seed-fertilizer technology adopted in the irrigated areas and which resulted in green revolution in the country has not yet been extended to the dry farming areas. Further increase in agricultural production can, therefore, be brought about through technological improvements in dry farming areas where yields per acre of various crops and the intensity of cropping are rather low as compared to those from the irrigated areas.

In Punjab, dry farming is commonly practised in southern parts of the Punjab State comprising Ferozepur, Bhatinda and Sangrur districts. The present study was carried out in Ferozepur district representing the dry farming areas of the State in the year 1969-70. The farmers of this area have both irrigated and unirrigated lands. It was, therefore, possible to examine the relative economics of irrigated and dry farming in this area. The objectives of this study were (*i*) to study the cropping pattern under unirrigated and irrigated conditions, and (*ii*) to examine the cost-benefit relations in crop production on dry and irrigated lands.

DESIGN OF THE STUDY

The multi-stage stratified random sampling technique with villages as the primary and operational holdings as the ultimate units of study was used for selecting the sample for this investigation.

This study was confined to district Ferozepur (Punjab). This district was divided into three zones based on agro-climatic conditions. This first

zone comprised Moga tehsil, the second zone consisted of Ferozepur and Zira tehsils and Jallalabad block of Fazilka tehsil while the third zone was constituted by Mukatsar and Fazilka tehsil excluding Jallalabad block of Fazilka tehsil. Dry farming was predominant in the third zone which was, purposively selected for this investigation. The quinquennial average rainfall ending December, 1969 in this area is 36.36 cms.[1]

The sample of this study was the same as the one selected from Mukatsar and Fazilka tehsils for the project entitled "Economics of Farm Management in Ferozepur District, Punjab."[2] Thus, a sample of 70 operational holidings selected under the "Farm Management Project," from seven randomly selected villages in these two tehsils was adopted for this study. From this sample, a sub-sample of 41 operational holdings practising dry farming along with irrigated farming was selected. The remaining 29 holdings which followed irrigated farming exclusively were ignored. As in the project under reference, the selected holdings were classified into five size-groups as below 6 hectares, 6 to 9 hectares, 9 to 14 hectares, 14 to 24 hectares and 24 hectares and above. The cross-sectional data on cropping pattern, yield, cost and return for the year 1969-70 were collected from the selected holdings with the help of specially constructed pre-tested schedules using the survey method.

RESULTS AND DISCUSSIONS

This study yielded useful results which are discussed below:

Cropping Pattern on Unirrigated and Irrigated Lands

The types of crops grown in an area depend upon the availability of moisture in the soil for plant growth. Since the moisture availability varied on unirrigated and irrigated plots, it was hypothesized that there would be a substantial difference in the cropping patterns followed on these two types of lands. The prevalent cropping pattern on the two types of land in the sample holdings is given in Tables I and II.

The irrigated area comprised 71.38 per cent of the cultivated area of the sample holdings. The remaining 26.62 per cent of the area was unirrigated. American cotton was the most important crop on irrigated area during the *kharif* season. This crop covered the largest percentage of the total irrigated area (45.11 per cent). The other major *kharif* crops in order of importance were fodder, cotton *desi*, *guara*, bajra *desi*, sugarcane, maize hybrid and paddy. The percentage irrigated area under these crops was 17.45, 14.87, 8.66, 5.00, 3.98, 0.94 and 0.76 respectively.

1. Statistical Abstract of Punjab, 1970, Publication No. 114, Controller of Printing and Stationery, Punjab, Chandigarh, p. 39.
2. This research project was started by the Punjab Agricultural University, Ludhiana in collaboration with the Directorate of Economics and Statistics, Ministry of Food and Agriculture, Government of India, New Delhi, on August 1, 1967.

TABLE I—CROPPING PATTERN ON IRRIGATED AND UNIRRIGATED PLOTS, SAMPLE FARMS: *Kharif* 1969-70 (*percentage*)

Crops	Farm size (hectares)											
	0 — 6		6 — 9		9 — 14		14 — 24		24 and above		Overall	
	Irri-gated	Unirri-gated	Irri-gated	Unirri-gated	Irri-gated	Unirri-gated	Irri-gated	Unirri-gated	Irri-gated	Unirri-gated	Irri-gated	Unirri-gated
Paddy	—	—	2·92	—	2·38	—	0·57	—	—	—	0·76	—
Sugarcane	7·33	—	5·17	—	2·38	—	2·18	—	3·94	—	3·98	—
Cotton *desi*	15·94	—	17·75	—	16·70	—	15·02	8·59	12·80	—	14·87	2·88
Cotton American	42·45	—	44·72	—	45·66	—	37·23	—	51·58	—	45·11	—
Bajra *desi*	13·54	36·38	—	—	3·24	14·74	2·94	18·60	4·58	17·74	5·00	17·80
Bajra hybrid	6·77	—	—	—	0·85	—	0·47	—	2·58	—	2·26	—
Maize *desi*	—	—	—	—	0·68	—	—	—	0·32	—	0·20	—
Maise hybrid	2·82	—	—	—	11·9	—	—	—	0·90	—	0·94	—
Oilseeds	—	—	0·45	—	—	—	—	—	—	—	0·05	—
Fodder	10·72	63·62	26·07	50·00	21·98	32·29	16·05	19·50	17·30	28·45	17·45	27·68
Guara	—	—	2·92	50·00	4·77	52·97	24·12	49·73	5·23	28·59	8·66	40·14
Vegetables	0·28	—	—	—	—	—	1·14	—	0·45	—	0·48	—
Pulses	—	—	—	—	—	—	—	3·58	0·32	25·22	0·12	11·50
San	0·15	—	—	—	0·17	—	0·28	—	—	—	0·12	—
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Total area (hectares)	(7·09)	(0·55)	(4·45)	(0·20)	(5·87)	(3·53)	(10·53)	(5·59)	(15·49)	(6·82)	(43·43)	(16·69)

Note: Figures in parentheses indicate the total cropped area in hectares in *kharif* season.

TABLE II—CROPPING PATTERN ON IRRIGATED AND UNIRRIGATED PLOTS, SAMPLE FARMS: *Rabi* 1969-70 (*percentage*)

Crops	Farm size (hectares)											
	0 — 6		6 — 9		9 — 14		14 — 24		24 and above		Overall	
	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated
Wheat Mexican	44·17	—	41·97	—	59·75	—	47·65	—	59·94	—	53·76	—
Wheat *desi*	12·08	—	11·92	—	8·69	2·03	7·15	22·86	9·29	—	9·29	5·35
Barley	—	—	14·51	14·80	1·48	—	0·76	3·16	—	—	0·39	2·28
Wheat + gram	—	56·47	2·33	9·76	5·72	20·57	1·67	19·22	9·13	47·92	6·97	33·96
Gram	17·92	4·46	8·55	21·30	10·17	31·53	18·26	15·28	6·22	24·42	9·84	21·61
Oilseeds	11·67	25·46	8·02	19·18	1·27	31·07	9·75	13·69	5·68	3·32	6·70	13·31
Barley + gram	—	13·61	11·66	34·96	0·42	14·80	5·48	25·79	2·68	24·34	3·40	23·49
Fodders	3·33	—	—	—	11·44	—	8·98	—	6·52	—	8·21	—
Gram + *taramira*	10·41	—	—	—	—	—	—	—	—	—	0·82	—
Wheat + barley	—	—	—	—	0·85	—	—	—	—	—	0·13	—
Vegetables	—	—	0·78	—	—	—	0·15	—	0·54	—	0·36	—
Pulses	0·42	—	0·26	—	0·21	—	0·15	—	—	—	0·13	—
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Total area (hectares)	(2·40)	(4·48)	(3·86)	(6·15)	(4·72)	(8·85)	(6·57)	(12·64)	(13·03)	(21·27)	(30·58)	(57·39)

Note: Figures in parentheses indicate total cropped area in hectares in *rabi* season.

Guara was the most important crop in the unirrigated area during the *kharif* season. This crop occupied 40.14 per cent of the total unirrigated area. The other dry farming *kharif* crops were fodder, bajra *desi*, pulses and cotton *desi*. The percentage of rain-fed area under these crops was 27.86, 17.80, 11.50 and 2.88 respectively.

During the *rabi* season, irrigated crops such as Mexican wheat, wheat *desi*, oilseeds, and fodder were sown on 53.96, 9.84, 9.29, 6.70 and 8.21 per cent of the total irrigated area respectively. Crop mixtures such as wheat plus gram and barley plus gram were more important on dry lands as compared with the irrigated ones. The percentage of unirrigated area under wheat plus gram, barley plus gram, gram and oilseeds worked out to 33.96, 23.49, 21.61, 13.31 and 2.28 respectively.

The difference in the cropping pattern in the unirrigated and irrigated areas during both the *kharif* and *rabi* seasons pointed out that the farmers adjusted their cropping schemes according to the available soil moisture.

Cropping Intensity

The intensity of cropping of dry and irrigated areas was studied as in Table III.

TABLE III—CROPPING INTENSITY ON UNIRRIGATED AND IRRIGATED AREAS, SAMPLE FARMS : 1969-70

(*percentage*)

Farm size (hectares)	Unirrigated area	Irrigated area
Below 6·00	92·00	166·35
6·00 to 9·00	91·32	122·82
9·00 to 14·00	87·69	122·06
14·00 to 24·00	90·31	128·25
24 and above	83·05	118·61
All farms	88·87	131·62

It will be seen from Table III that the cropping intensities in the unirrigated and irrigated areas worked out to 88.87 and 131.62 per cent respectively. This difference in the cropping intensities in the two areas was statistically tested by using "paired t-test." The t-value worked out to 3.457 which was significant at 1 per cent level of significance. It showed that the intensity in the irrigated area was significantly higher than that in the unirrigated area.

The cropping intensity showed a tendency to decline with the increase in the size of the holding both in the unirrigated and irrigated areas. The variation in cropping intensity between the size-groups was statistically tested. In the unirrigated area the F-ratio was 0.31, which was not significant at 5 per cent level. But the F-ratio for irrigated plots was 3.727, which was significant at 5 per cent level of significance.

Cost-Benefit Relations in Crop Production in Irrigated and Unirrigated Areas

The cost-benefit relations in crop production in the irrigated and unirrigated areas were studied by examining the cost structure, yields and net returns per hectare of major crops.

(*a*) *Cost Structure of Major Crops*

The cost structure of major crops grown in the study area is as shown in Table IV. The analysis of the data in the table indicates that the rent of land and human labour were two important cost components accounting for 32.91 to 49.67 per cent and 20.50 to 29.44 per cent of the total costs of the irrigated and unirrigated crops. The expenditure on human labour was more in the irrigated land than in the unirrigated land.

It is evident that the selected farmers used meagre amounts of capital intensive and yield increasing inputs such as fertilizers, farmyard manure and insecticides in the unirrigated areas. Relatively larger quantities of these inputs were used in the irrigated areas. Consequently, the per hectare cost of cultivation of various crops was relatively more in the irrigated areas as compared to that in the unirrigated areas. The total cost per hectare for irrigated *guara*, bajra *desi*, gram, wheat plus gram and barley plus gram worked out to Rs. 871.98, Rs. 844.19, Rs. 965.89, Rs. 769.66 and Rs. 796.75 respectively. These costs for unirrigated crops were calculated at Rs. 506.06, Rs. 497.41, Rs. 517.82, Rs. 607.67 and Rs. 767.78 respectively.

(*b*) *Yields Per Hectare of Major Crops in Irrigated and Unirrigated Areas*

The per hectare average yields of major *kharif* and *rabi* crops in the irrigated and unirrigated areas are set out in Table V.

It will be seen from Table V that the average yields per hectare of different crops were higher in the irrigated area as compared to those in the unirrigated area. The low yields in the latter case can be partially attributed to the fact that little fertilizers and other yield increasing inputs were used in raising these crops.

The variation in yields per hectare of various crops in the irrigated and unirrigated areas was studied by working out the coefficients of variation. These coefficients are shown in Table VI.

It will be seen from Table VI that the coefficient of variation for yield per hectare of crops such as *guara*, gram, wheat *desi*, and wheat plus gram is relatively higher in the unirrigated area than in the irrigated area. Crops such as bajra *desi*, pulses, barley, barley plus gram and oilseeds, which can withstand drought conditions better had, however, more stable yields in the unirrigated area. Consequently their coefficients of yield variation were smaller for the unirrigated area than for the irrigated area.

TABLE IV—COST STRUCTURE OF MAJOR CROPS PER HECTARE IN IRRIGATED AND UNIRRIGATED AREAS, SAMPLE FARMS : 1969-70

(*percentage*)

Item of expenditure	*Guara*		Bajra *desi*		Gram		Wheat+gram		Barley+gram	
	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated
1. Human labour	20·50	25·03	22·42	28·62	22·35	23·55	25·23	20·68	29·44	27·64
(*a*) Family labour	7·58	16·38	14·65	15·17	10·73	11·63	9·09	8·84	28·65	12·34
(*b*) Permanent hired	10·28	6·70	5·21	12·99	6·74	8·84	12·93	8·50	—	12·06
(*c*) Casual hired	2·64	1·95	2·56	0·46	4·88	3·08	3·21	3·34	0·79	3·24
2. Bullock labour	9·78	18·86	13·51	15·67	8·12	14·48	5·79	25·36	20·81	21·40
(*a*) Owned	9·78	18·86	13·31	15·42	8·12	14·39	5·79	25·36	20·81	21·40
(*b*) Hired	—	—	0·20	0·25	—	0·09	—	—	—	—
3. Seeds	3·69	5·48	1·50	2·35	6·83	9·57	5·56	8·72	5·72	6·86
4. Farmyard manure	0·38	—	3·88	—	—	—	—	—	—	—
5. Artificial fertilizer	2·30	—	3·61	1·00	2·61	—	3·66	—	2·67	—
6. Insecticides and pesticides	—	—	—	—	—	—	—	—	—	—
7. Expenditure on farm machinery and its depreciation	4·50	1·21	3·79	1·17	4·72	0·09	3·33	3·63	1·79	4·52
8. Depreciation of farm building and implements	1·59	2·00	1·48	3·38	2·02	4·10	0·93	1·72	0·82	2·76
9 Irrigation (water rates)	1·14	—	0·54	—	1·79	—	1·76	—	0·72	—
10. Interest on										
(*a*) Working capital	1·59	0·58	2·61	0·38	3·64	1·02	1·28	1·16	1·64	0·81
(*b*) Fixed capital	3·50	3·26	2·47	4·56	3·00	4·05	3·97	3·14	1·44	3·27
11. Land revenue and taxes	0·27	0.44	0·24	0·43	0·26	0·68	0·32	0·41	0·12	0·44
12. Rent of land	49·67	41·03	41·84	40·21	43·40	39·91	46·92	32·91	34·36	31·01
13. Miscellaneous	1·09	2·11	2·11	2·23	1·26	2·55	1·25	2·27	0·47	1·29
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Total cost (Rs.)	871·98	506·06	844·19	497·41	965·89	517·82	769·66	607·67	796·75	767·78

TABLE V—YIELD PER HECTARE OF MAJOR CROPS IN UNIRRIGATED AND IRRIGATED AREAS, SAMPLE FARMS : 1969-70

(quintals)

Crops		Farm size (hectares)					
		0—6	6—9	9—14	14—24	24 and above	overall
Bajra *desi*	a	2·14	—	8·06	3·14	3·63	4·24
	b	5·00	—	2·00	—	—	3·50
Cotton *desi*	a	6·15	5·45	11·64	7·39	10·69	8·26
	b	—	—	—	0·48	—	0·48
Guara	a	—	—	11·46	6·85	6·75	8·35
	b	—	6·00	0·14	2·99	1·55	2·67
Pulses	a	—	—	—	1·60	4·88	3·24
	b	—	—	—	1·00	0·62	0·81
Gram	a	2·17	8·73	6·73	5·08	10·76	6·69
	b	3·50	6·52	6·53	6·69	7·26	5·92
Wheat	a	10·98	6·94	10·53	16·87	16·87	12·43
	b	—	—	4·20	8·86	—	6·53
Wheat + gram ..	a	—	0·30	4·86	13·64	6·58	6·34
	b	3·48	1·33	1·87	11·03	2·52	4·05
Barley	a	—	—	6·54	16·72	—	11·63
	b	—	2·31	—	2·00	—	2·15
Barley + gram ..	a	—	3·21	18·33	3·95	—	8·49
	b	3·72	3·07	6·38	4·73	6·75	4·93
Oilseeds	a	3·11	1·72	11·54	2·11	10·62	5·82
	b	2·72	7·03	3·49	4·37	9·28	5·38

Note : a = Yield in irrigated area.
b = Yield in unirrigated area.

TABLE VI—COEFFICIENT OF VARIATION FOR YIELDS PER HECTARE FOR DIFFERENT CROPS, SAMPLE FARMS : 1969-70

Crops	Unirrigated	Irrigated
Bajra *desi*	56·48	107·36
Cotton *desi*	—	67·14
Guara	162·62	79·38
Pulses	33·21	71·54
Gram	49·85	44·25
Wheat *desi*	35·68	31·21
Wheat + gram	87·90	75·55
Barley	14·42	43·77
Barley + gram	29·21	81·98
Oilseeds	45·17	74·40

Note : Coefficient of variation for unirrigated cotton *desi* was not worked out because it had only one observation.

(c) *Income from Major Crops*

The returns and different costs per hectare of major crops on the sample holdings are shown in Table VII.

TABLE VII—PER HECTARE COSTS AND RETURNS FROM MAJOR CROPS IN IRRIGATED AND UNIRRIGATED AREAS, SAMPLE FARMS : 1969-70

(*rupees*)

Crops		Cost A_1*	Cost A_2*	Cost B*	Cost C*	Gross returns	Returns on cost A_2 basis
Guara	I	342·26	396·72	805·88	871·98	656·19	+259·47
	U	199·01	206·63	423·15	506·66	425·41	+299·43
Bajra *desi*	I	346·49	370·22	720·53	844·19	433·76	+ 63·54
	U	199·29	199·29	421·94	497·41	403·07	+203·78
Gram	I	513·54	581·32	862·25	965·89	675·61	+ 94·29
	U	229·97	236·64	457·59	517·82	603·88	+367·24
Wheat + gram	I	308·01	314·39	699·68	769·66	715·69	+401·30
	U	324·90	324·90	543·96	607·67	361·23	+ 36·33
Barley + gram	I	283·24	423·56	568·48	796·75	566·98	+143·42
	U	409·84	447·96	673·03	767·78	396·22	— 51·74

Note : I = Irrigated crop.
U = Unirrigated crop.

* Cost A_1 = All cash and kind expenses actually incurred, less rent, it comprises wages of hired human labour, value of bullock labour (owned or hired), seed, manure, fertilizers, insecticides and pesticides, irrigation charges, etc., water rates, interest paid on capital, depreciation and other repair charges.

Cost A_2 = Cost A_1 + rent paid for leased-in land.
Cost B = Cost A_2 + rental value of owned land + interest on fixed capital.
Cost C = Cost B + imputed value of family labour.

The returns on cost A_2 basis in the case of *guara*, bajra *desi* and gram crops, were more in the unirrigated area as compared to that in the irrigated area. Wheat plus gram and barley plus gram mixture gave better returns to fixed factors in the irrigated area as compared to the unirrigated area. But unirrigated barley plus gram mixture did not cover even the variable expenses. In this case, the returns to fixed farm resources was a negative figure.

CONCLUSION

It may be concluded from this study that crops such as American cotton, *desi* cotton and Mexican wheat were more important in the irrigated area whereas *guara*, bajra *desi*, gram and barley plus gram were more important in the unirrigated area.

The cropping intensity, cost of cultivation, yields per hectare and gross income per hectare of major crops were more in the irrigated area as compared to that in the unirrigated area. However, per hectare returns to fixed farm resources from *guara*, bajra *desi* and gram were more in the unirrigated area but crop mixtures such as wheat plus gram and barley plus gram gave more returns in the irrigated area.