

ECONOMICS OF WINTER CROPS IRRIGATED WITH SODIC WATER

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A sizeable proportion of underground waters in arid and semi-arid parts of northern India are sodic in nature (Gupta 1979). Such waters are invariably used for irrigating rabi crops particularly wheat on land under fallow in kharif having light to medium texture soil. The yield reduction is noticed only after 5 to 6 years of cropping. The present study was undertaken to evaluate the suitability and to work out the economics of different rabi crops under sodic water condition with and without gypsum application.

In a field, continuously raising wheat in rabi with irrigation of 12.0 meL^{-1} RSC water for more than a decade, an experiment was conducted to compare economics of the rabi crops viz., field pea (Bonneville), chickpea (H-208), mustard (RH 30), barley (BH 75) and wheat (WH 283) irrigated with sodic water (SAR 19.3, EC 1.9 dSm^{-1}), as such and after neutralising RSC with gypsum as per requirement of the total quantity of water used as irrigation for each crop. The soil was lomy sand having pH 9.4, EC (1 : 2) 0.42 dSm^{-1} and ESP 38.5. In all, three irrigations of 5 cm each were given to fieldpea, chickpea and mustard whereas four and six irrigations were given to barley and wheat, respectively. Gypsum was applied @ 80 kg ha^{-1} per unit increase in RSC over 2.5 meL^{-1} of irrigation water. The experiment replicated thrice in a split plot design was carried out for two consecutive seasons (1986-87 and 1987-88). The soil samples (30 cm) after harvest of crops were taken and analysed for pH (Richards 1954). Economics was calculated considering the expenditure incurred on different operations actually performed during the crop season. The cost of commodities and labour charges were computed on the basis of prevalent market prices.

The data presented in Table 1 indicate that gypsum application decreased the soil pH under all the crops during both the seasons. Similar results were obtained by Verma and Abrol (1980) and Manchanda et al. (1985). However, the decrease was more under barley and wheat as compared to field pea, chickpea and mustard. The low values of pH under wheat and barley may be attributed to higher amount of gypsum applied due to more number of irrigations which helped in leaching sodium to lower depths. Barley showed maximum tolerance to sodicity followed by wheat,

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mustard, fieldpea and chickpea (Table 2). The average data of two years revealed that when irrigations were applied without gypsum, rabi pulses viz., chickpea and fieldpea yielded very low (0.1 and 1.4 qha^{-1}) as compared to cereals viz., barley (32.34 qha^{-1}) and wheat (25.02 qha^{-1}). As a result of gypsum application, though, no remarkable increase in grain yield of chickpea (6.21 qha^{-1}) was noticed, a respectable yield gain of 12.78 , 17.81 , 15.54 and 22.37 qha^{-1} in fieldpea, mustard, barley and wheat, respectively was obtained. However, the per cent increase in grain yield with the application of gypsum was higher in chickpea and fieldpea than barley and wheat. Singh and Abrol (1988) also obtained just double yield of wheat with the application of gypsum.

A steep rise in net returns was recorded in all the crops when gypsum was applied (Table 3). Mustard earned maximum profit of Rs. 8092/- followed by wheat

Table 1. Effect of gypsum application on soil pH after harvesting rabi crops

Crops	No. of irrigations	Without gypsum		With gypsum	
		1986-87	1987-88	1986-87	1987-88
Fieldpea	2	9.59	9.65	9.52	9.57
Chickpea	2	9.58	9.64	9.50	9.54
Mustard	2	9.57	9.63	9.45	9.51
Barley	4	9.63	9.78	9.42	9.48
Wheat	6	9.65	9.79	9.37	9.42

Table 2. Effect of gypsum application on grain yield (q/ha) of different crops.

Crops	Without gypsum		With gypsum	
	1986-87	1987-88	1986-87	1987-88
Fieldpea	1.85	0.95	15.56	12.80
Chickpea	0.11	0.10	6.85	5.78
Mustard	6.81	3.88	25.37	20.94
Barley	37.86	26.83	52.59	43.17
Wheat	24.72	25.33	48.15	46.64

Table 3. Comparative economics of rabi crops grown with and without gypsum to sodic water condition (two years average).

Crops	Without gypsum			With gypsum			Returns per rupee invested on gypsum (Rs.)
	(Rs ha ⁻¹)			(Rs ha ⁻¹)			
	Cost of cultivation	Gross income	Net returns	Cost of cultivation	Gross income	Net returns	
Fieldpea	4162	635	-3527	4280	6632	2352	12.9
Chickpea	3850	103	-3747	4130	3856	-274	7.6
Mustard	4387	3254	-1133	4668	12866	8092	20.2
Barley	5612	6765	1154	6173	10068	3895	4.8
Wheat	6113	6426	312	6952	11990	5538	7.3

and barley per hectare. High returns with mustard are attributed to higher yield increase with gypsum application in addition to higher market price. The net returns given by fieldpea were quite low as compared with oilseed and cereals. Chickpea cultivation under went a net loss of Rs. 274 ha⁻¹ even with gypsum application. When gypsum was not applied, maximum profit was given by barley (Rs. 1154/ha) followed by wheat. The mustard, fieldpea and chickpea cultivation resulted in a net loss of Rs. 1133/-, Rs. 3527/- and Rs. 3747⁻¹ha, respectively. The maximum return per rupee invested on gypsum were with raya (Rs. 20.2) and minimum were with barley (Rs. 4.8). It may, therefore, be concluded that a good crop of mustard, wheat, barley and fieldpea could be harvested in light textured soils even if highly sodic water of low EC is used for irrigation, provided gypsum is applied as per requirement of irrigation water before a heavy presowing irrigation.

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