Table 2. Effect of sowing dates and cultivars on yield and economics

Treatments	Grain yield (q/ha)		Straw yield (q/ha)		Gross return (Rs/ha)		Net return Rs/ha		Mean
	1986-87	1987-88	1986-87	1987-88	1986-87	1987-88	1986-87	1987-88	
Sowing dates									
December 5	34.3	30.2	50.0	45.3	12604	11174	7014	5584	6299
December 20	29.3	26.4	46.5	42.2	10994	9924	5404	4334	4869
January 6	22.7	19.7	41.0	34.5	8816	7586	3226	1996	2611
C.D at 5%	5.2	4.4	3.8	3.9	-	-	-	-	-
Cultivars									
HM-135	31.5	27.6	47.3	41.6	11658	10224	6068	4634	5351
K.816	32.9	28.5	39.4	34.7	11576	10062	5986	4472	5229
Sonalika	30.9	25.9	51.0	43.7	11712	9874	6122	4284	5203
H.D.1982	23.6	21.1	39.4	37.3	8972	8146	3382	2556	2969
H.P.1209	30.7	27.2	49.2	42.8	11548	10184	5958	4594	5276
HUW-37	25.1	22.3	47.8	42.6	9896	8800	4306	3210	3758
K 7410	21.0	20.4	40.3	38.1	8298	7998	2708	2408	2558
UP-115	34.4	30.5	52.4	44.6	12776	11216	7186	5624	6405
C.D. at 5%	4.1	4.9	6.2	3.2	-	-	-	-	-

Note : Prevailing local prices have been considered for grain and straw yield (May 1991) Grain @ Rs 280/q and straw @ Rs 60/q

followed by subsequent dates. UP-115 gave highest net profit (Rs.6405.00/ha) while K-7410 appeared to provide lowest income (Rs.2558.00/ha).

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NITROGEN FERTILISATION AND IRRIGATION SCHEDULING IN MUSTARD UNDER JAWAI COMMAND AREA OF RAJASTHAN

G.S.CHOUHAN, ISHWAR SINGH and DILIP SINGH.

Department of SWC, College of Technology and Agricultural Engineering, Udaipur 313 001.

ABSTRACT

Investigations carried out for two years (89-90 and 90-91) at ARS, Sumerpur (Rajasthan Agricultural University) in sandy loam soil reveal that increasing levels of nitrogen upto 90 kg/ha significantly increased yield attributes, chlorophyll content of leaves, seed yield and oil content of mustard during both the years. Three irrigations to this crop at vegetative, flowering and seed development stages were found appropriate when judged in terms of yield, yield attributes and chlorophyll content. Oil content of seed was also improved significantly due to two (at veg. + flowering stage) and three irrigations compared to one (at vegetative stage).

Mustard (*Brassica juncea* (L.) Czern and Coss) is an important crop of Jawai Command Area of Rajasthan in about 50,000 ha. However, average productivity of the crop is low (5.1 q/ha) due to low nitrogen fertilisation (30 kg/ha) and poor irrigation management. Generally, 2-3 irrigations are made available (excluding pre-sowing) in command area due to shortage of water as a major portion is kept reserve for civil supplies. However, irrigation schedule is not properly defined due to lack of research based recommendations hitherto.

Since the judicious use of water and balanced nitrogen fertilisation are the two most important

Table 1. Effect of nitrogen fertilisation and irrigation schedule on yield attributes and chlorophyll content (mg/g) of mustard.

Treatment		Primary branches/plant		Siliquae/plant		Seeds/siliquae		1000 seed weight (g)		Chlorophyll (Pooled)*	
		89-90	90-91	89-90	90-91	89-90	90-91	89-90	90-91	'a'	'b'
N (kg/ha)	0	4.33	3.91	86.0	80.6	8.4	8.2	5.01	5.16	1.220	0.563
	30	4.55	4.27	97.2	96.7	9.7	9.4	5.05	5.18	1.240	0.584
	60	5.00	4.98	104.4	102.3	10.2	11.1	5.30	5.28	1.372	0.610
	90	5.44	5.37	118.7	115.5	11.3	11.0	5.28	5.34	1.440	0.677
CD 5%		NS	1.23	7.7	6.9	1.9	2.0	0.14	0.07	0.062	0.020
Irrigation schedule :											
At veg.stage		3.83	3.91	72.1	75.0	9.9	8.7	5.05	5.13	1.207	0.553
At veg. + flowering stage		5.50	4.50	108.0	105.2	9.3	10.1	5.10	5.24	1.303	0.604
At veg. + flowering stage+seed dev. stage		5.16	5.01	118.6	116.1	10.5	11.0	5.23	5.35	1.444	0.668
CD 5%		1.29	NS	6.7	5.4	NS	1.7	0.12	0.06	0.052	0.017

Vegetative, flowering and seed development stages were taken at 30,55 and 80 days after sowing.
* Chlorophyll content of leaves (pooled of two years) at 85 days after sowing.
NS : Not significant

factors of production in mastard (Slatyyer, 1969; Singh and Dixit, 1989), this experiment was framed to find out appropriate nitrogen dose and irrigation schedule to achieve higher yield under limited resource conditions.

MATERIALS AND METHODS

The experiments were laid-out during *rabi* seasons of 1989'90 and 1990'91 at the Agricultural Research Station, Sumerpur (Rajasthan) in randomized block design with three replications, comprising of four nitrogen levels and three irrigation schedules (Table 1). The soil was sandy loam in texture with a pH of 7.8, low available nitrogen and medium levels of phosphorus and potassium. The mean evaporation during pendency of crop growth was 2.64 mm/day. Variety T-59 was sown on Sep.28, 1989 and Oct.10, 1990. One weeding was done at 20 days after sowing. The net plot size was 15.0 m^2.

RESULTS AND DISCUSSION

Effect of nitrogen fertilisation

Increasing levels of N upto 90 kg/ha has significantly increased siliquae/plant, chlorophyll content of leaves, seed yield and oil content during both the years of investigation (Tables 1, 2). However, response was noted up to 60 kg only when judged in terms of 1000 seed weight. On an average, application of N at 90 kg/ha produced about

Table 2. Effect of nitrogen fertilisation and irrigation schedule on yield, oil content of mustard seed and net returns (Rs/ha)

Treatment		Seed yield (q/ha)			Oil content (%)			Net return (Rs/ha)		
		89-90	90-91	Mean	89-90	90-91	Mean	89-90	90-91	Mean
N (kg/ha)	0	5.95	7.94	6.94	36.12	35.67	35.89	2225	4352	3288.5
	30	6.08	8.79	7.43	36.10	35.91	36.00	2144	4874	3509.0
	60	9.64	11.31	10.43	37.01	36.76	36.88	4474	6724	5599.0
	90	12.94	14.84	13.89	37.98	37.62	37.80	6622	9386	8004.0
CD 5%		1.11	1.30	-	0.40	0.37	-	534.24	651.3	-
Irrigation schedule :										
At veg.stage		5.07	6.95	6.01	36.43	36.07	36.25	1199	3460	2479.5
At veg. + flowering stage		9.32	11.14	10.23	37.10	36.66	36.88	4104	6712	5408.0
At veg. + flowering stage+seed dev. stage		12.09	14.07	13.08	37.31	36.74	37.02	62.13	8956	7584.5
CD 5%		0.96	1.12	-	0.34	0.31	-	462.04	561.12	-

100, 87 and 33 per cent higher seed yield over 0, 30 and 60 kg, respectively. Corresponding increase in oil content were 5.32, 5.00 and 2.49 per cent.

Adequate availability of N a. soil solution due to higher nitrogen application might have improved chlorophyll synthesis (Rathore and Manohar, 1989), net assimilation rate and thereby producing more carbohydrates (Antil *et al.*, 1986). Thus, overall improvement in yield attributes has ultimately influenced the seed yield (Singh and Dixit, 1989). The correlation coefficients of seed yield with primary branches/plant, siliquae/plant, seeds/siliquae, 1000 seed weight and chlorophyll content were found significant in both the years under present investigation indicating that increase in yield was due to significant increase in these yield components. Tomar and Namdeo (1989) also proved that 90 kg N/ha was found superior in respect of seed yield and net returns. The maximum net monetary returns of Rs.6622/- and Rs.9386/- were received with 90 kg N/ha which were significantly higher over 60, 30 and kg N/ha during both the years, respectively.

Effect of irrigation schedule

Significant variation in yield attributes, chlorophyll content of leaves, yield and oil content of seed was recorded due to differential irrigation schedule (Tables 1, 2). Irrigations provided at vegetative, flowering and seed development stages had significantly increased seed yield by about 138 and 102 per cent over one irrigation (at vegetative stage); and 29.7 and 26.3 per cent over two irrigations (at vegetative + flowering stage) during 89-90 and 90-91, respectively. However, difference in seed yield was found significant due to one and two irrigations also. Oil content of mustard seed was also improved significantly due to two and three irrigations compared to one. It is also obvious from data of net monetary returns that Rs.6213 and 8956/ha were obtained under three irrigation, respectively during 1989-90 and 1990-91, which were significantly higher over two and one irrigation.

Ample supply of soil moisture may lead to profuse root development (Raja and Bishnoi, 1990), thereby absorption of more nutrients at critical stages which ultimately might have increased seed yield and oil content. Several workers found that three irrigations at these stages have increased seed yield and oil content of mustard (Mathur and Tomar, 1972; Bhan, 1981; Patel *et al.*,1989). Reduction in yield and yield attributes under one irrigation at vegetative stage might be due to water stress which could not meet the atmospheric evaporative demand (Siag and Verma, 1990).

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