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Input management for sustaining mustard (*Brassica juncea*) production under late-sown semi-arid situations of Rajasthan

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ABSTRACT

A field experiment was conducted during 1993-94 to 1995-96 to study the effect of different agronomic inputs for taking good sustainable yield of mustard *[Brassica juncea* (L.) Czernj. & Cosson] under late-sown conditions. Maximum seed yield of mustard was recorded in all the years where all the four major agro-inputs, viz. thinning, fertilizer, irrigation and plant protection, were used as per recommendations. Considering the single factor, irrigation proved to be the most critical input in this semi-arid region, when there was no winter rains and rainfall during the season was low or normal. The reduction in the yield under no irrigation was up to 39% followed by fertilizer which contributed up to 28 % yield. During the year when rainfall was more than normal, that too up to October and was accompanied with winter rain, fertilizer contributed to the yield up to 38% and proved the most critical. In its absence reduction in the mustard yield was up to 38 %. This was followed by plant-protection measures, as during the years of sufficient rainfall in rainy season with winter rains the infestation of diseases and pests was much more, causing great reduction in yield. Thus during the years of scanty rainfall for taking good yield of mustard, irrigation and fertilizer are the most critical inputs in this semi-arid tract; whereas during the years of sufficient rainfall, fertilizer and plant-protection measures are the most critical inputs for taking good sustainable production of mustard.

Key words: Mustard, Late sowing, Input management

In India rapeseed-mustard are grown on 6.71 million ha, with production of 4.94 million tonnes (1997-98), which contribute 25.6% in area and 22.2 % in production of total oilseeds. Among the four major rapeseed-mustard growing states, viz. Rajasthan, Uttar Pradesh, Madhya Pradesh and Harayana, Rajasthan alone contributes 49% in area (3.28 million ha) and 50.5 % in (2.49 million tonnes) production of total rapeseed-mustard.

In Rajasthan, Bharatpur division

Table 1. Yield attributes of mustard as influenced by different agro inputs under late-sown conditons during 1993-94 to 1995-96

Treatment	No. of branches/plant			No. of siliquae/plant			No.of seeds/siliqua			1,000-seed weight		
	1993-94	1994-95	1995-96	1993-94	1994-95	1995-96	1993-94	1994-95	1995-96	1993-94	1994-95	1995-96
T_1	15.9	24.0	15.0	121	204	239	14.1	14.7	11.0	4.8	5.4	6.2
T_2	24.2	25.3	19.0	220	211	253	14.5	15.7	11.0	4.7	6.2	5.4
T_3	16.4	24.6	15.0	145	250	215	12.2	14.4	11.0	4.6	5.5	5.5
T_4	19.0	20.8	15.0	145	226	220	12.7	16.3	11.0	4.4	5.7	5.8
T_5	14.8	19.3	11.0	168	179	204	12.6	15.0	11.0	5.0	6.4	6.3
T_6	15.7	18.4	17.0	176	199	280	12.3	12.3	12.0	4.8	6.3	6.5
T_7	15.0	23.5	11.0	139	208	146	12.7	14.3	10.0	4.7	6.4	6.4
T_8	12.3	24.2	11.0	107	189	181	10.6	14.2	11.0	4.9	6.6	7.1
T_9	16.3	26.2	13.0	117	246	188	11.4	14.6	11.0	4.3	6.4	6.3
T_{10}	18.5	21.8	15.0	99	213	82	11.6	13.6	11.0	4.7	6.5	6.9
T_{11}	13.0	18.6	12.0	104	179	147	13.2	14.6	11.0	4.4	6.3	5.9
T_{12}	11.2	16.6	19.0	84	162	159	10.9	15.2	12.0	4.4	6.1	6.2
T_{13}	14.9	21.9	10.0	101	239	140	12.6	14.6	10.0	4.4	5.6	6.0
T_{14}	16.5	24.2	11.0	148	139	204	12.4	12.8	12.0	4.6	6.4	6.6
T_{15}	14.9	25.2	15.0	12.7	13.9	92	14.0	12.7	10.0	4.9	6.6	6.8
CD (P=0.05)	621	NS	6.21	NS	NS	98	NS	NS	NS	NS	NS	0.3

T_1 = Broadcast sowing with recommended practice, T_2 = recommended practice: T_3 = recommended practice without thinning; T_4 = recommended practice without fertilizer; T_5 = recommended practice without irrigation; T_6 = recommended practice without plant protection; T_7 = recommended practice without thinning and fertilizer; T_8 = recommended practice without thinning and irrigation; T_9 = recommended practice without thinning and plant protection; T_{10} = recommended practice without fertilizer and irrigation; T_{11} = recommended practice without fertilizer and plant protection; T_{12} = recommended practice without thinning, fertilizer and plant protection; T_{13} = recommended practice without thinning, irrigation and plant protection; T_{14} = recommended practice wihout thinning, irrigation and plant protection; and T_{15} = recommended practice without thinning, fertilizer, irrigation and plant protection.

contributes 38.3 % in area and 41.5 % in production of rapeseed-mustard. Due to changed cropping pattern and aberrant or subnormal weather conditions, farmers are compelled to grow mustard under late-sown condition, for which no production technology is available. Therefore the present investigation was carried out to evaluate the relative contribution of agronomic inputs in influencing the productivity of Indian mustard under late-sown conditions at Bharatpur during 1993-94 to 1995-96.

MATERIALS AND METHODS

a field experiment was conducted at NRCRM, Bharatpur during winter *(rabi)* season, 1993-94 to 1995-96. The experiment was laid out in randomized block design and replicated thrice, taking 15 treatments.

The soil was sandy loam in texture, medium in available nitrogen (0.6% organic C), phosphorus (23.5% kg/ha) and potassium (230, kg/ha) with pH 8. Mustard variety 'PCR 7' was sown at a row distance of 30 cm on 25 November 1993, 22 November 1994 and 10 November 1995 during 1993-94 to 1995-96 crop seasons. There was winter rain during 1994-95 year. Full dose of phosphorus and half dose of nitrogen through diammonium phosphate and urea were applied at the time of sowing. The oil content in seed was determined by NMR technique. Data on yield reduction (%) obtained after withdrawal of inputs as per treatment from recommended package was analysed statistically after regular transformation

RESULTS AND DISCUSSION

The seed yield was maximum when all the recommended practices (thinning, fertilizer, irrigation and plant protection) were followed. The broadcast sowing (T_1) gave 14-20 % lower seed yield compared with the recommended practice (T_2). The highest seed yields of 1505.6, 1193.0 and 1392.0 kg/ha were obtained during 1993-94, 1994-95 and 1995-96 respectively when recommended practices were adopted (Table 2). Maximum reduction in seed yield was recorded in treatment where all the four agro-inputs were not used. Among the single factor, irrigation was the most important during the years of dry winter, i.e. 1993-94 and 1995-96, in this semi-arid tract, as maximum loss of 28.4 to 39 % was observed when no irrigation was applied compared with the recommended practice. The next component after irrigation was fertilizer, where the yield reduction was 23% (1995-96) and 31 % (1993-94). During 1994-95 there was sufficient rain in rainy season along with winter rains, due to which fertilizer proved to be the single most important factor, contributing to 38 % in seed yield. Among different combinations of two components, irrigation and fertilizer was the most important, except during 1994-94 due to sufficient moisture and humidity, and hence thinning and plant protection was the most crucial factor when there was heavy attack of aphids.

The increase in the seed yield in plots where all the agro-inputs were applied as per recommendation was due to increase in the number of branches/plant, which

Table 2. Seed yield and oil content of mustard as influenced by different agro-inputs under late-sown conditions during 1993-94 to 1995-96

Treatment	Oil content			Seed yield (kg/ha)			Oil yield (kg/ha)		
	1993-94	1994-95	1995-96	1993-94	1994-95	1995-96	1993-94	1994-95	1995-96
T_1	39.1	41.2	38.8	1,257	951	1,204	491	392	467
T_2	38.7	37.8	37.5	1,506	1,193	1,392	583	451	522
T_3	39.6	40.9	38.3	962	827	1,024	381	338	392
T_4	38.6	39.4	38.8	938	741	1,074	362	292	417
T_5	39.4	41.4	38.1	913	948	997	360	392	380
T_6	39.8	38.8	38.9	1,110	1,364	1,317	442	529	512
T_7	39.6	40.6	38.5	913	569	780	362	231	300
T_8	40.2	39.7	37.7	913	890	1,062	367	353	400
T_9	38.8	40.1	39.4	691	510	1.127	368	209	444
T_{10}	39.5	40.7	38.5	994	563	598	393	229	230
T_{11}	40.8	40.9	38.5	612	777	1,080	250	318	416
T_{12}	38.9	38.8	37.5	592	1,346	949	230	522	356
T_{13}	39.0	40.9	38.1	765	819	580	298	335	221
T_{14}	40.8	40.2	38.7	666	1,406	885	272	565	342
T_{15}	40.0	39.7	38.6	689	1,016	453	276	403	175
CD (P = 0.05)	N.S.	N.S.	N.S.	326	320	321	-	-	

ultimately resulted in more number of siliquae/plant. The number of seeds/siliqua was also the highest in these plots. The yield attributes (number of branches/plant, number of siliquae/plant and number of seeds/siliqua) decreased significantly where irrigation and fertilizer were not applied compared with the recommended package. Singh and Verma (1993) and Thakur and Singh (1997) also reported the importance of irrigation and fertilizer on growth, yield attributes and seed. Bhati and Rathore (1982) and Roy and Tripathi (1985) also reported the superiority of fertilizer and irrigation as critical inputs to other agronomic inputs for increasing the seed yield of Indian mustard.

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