

sown with a spacing of 30 x 10 cm. Total nitrogen and phosphorus in plant materials at successive stages of crop growth were estimated by the modified kjeldahl method and Vanadomolybdo-phosphoric yellow colour method, respectively.

The nitrogen content and uptake recorded due to 25 kg N/ha respectively were 1.8 per cent and 83.9 kg N/ha and were higher when compared with control (1.7% and 68.7 kg N/ha). Further increase in the N level to 50 kg/ha did not increase the nitrogen uptake (86.9 kg/ha) significantly, though the nitrogen content in plant was higher. This may be because of decrease in the rate of dry matter production with the increasing N level. These results are in close conformity with the findings of Singh and Prasad (1976). The phosphorus content and the total uptake due to 25 kg N per ha were 0.16% and 7.37 kg P/ha and were higher as compared with control (0.12% and 4.45 kg P/ha respectively) (Table 1).

The nitrogen content and uptake due to 100 kg P_2O_5 /ha were 1.83% and 87.22 kg N/ha and were higher than under control (1.78% and 73.22 kg N/ha, respectively). Similarly, P content and uptake respectively

were 0.17% and 8.21 kg P/ha due to 100 kg P_2O_5 /ha as compared to control (0.14% and 5.98 kg P/ha) (Table 1). This may be attributed to increased N and P content coupled with increased dry matter production resulting in higher N and P uptake respectively.

The fertilizer dose of 25 kg N and 100 kg P_2O_5 /ha was found to be optimum, recording the maximum seed yield, stalk yield and returns, through increased uptake of nitrogen and phosphorus. Further increase in the fertilizer dose resulted in decrease in the returns (Rs/Re spent on fertilizers) due to decrease in seed yield and increase in cost of fertilizers (Table 1).

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Wheat and Mustard Intercropping at Different Row Proportions

Farmers in the dryland regions of north Karnataka grow wheat under rainfed situations for its grains for home consumption and nutritious fodder for their cattle. Often they raise the crop under mixed cropping

situation with variety of crops, particularly the oilseeds which provide them some cash returns. Mustard is one such crop which finds a place with wheat and it is usually broadcasted in the drill sown wheat preferably

Table 1. Yield and yield parameters of wheat, mustard grain, yield, gross returns and LER as influenced by different row proportions in intercropping system

ROW	Proportion of Wheat and Mustard (W : M)	Wheat				Grain yield (kg/ha)	Straw yield (kg/ha)	Grain yield of mustard (kg/ha)	Gross returns (Rs./ha)	LER
		Number of tillers/ metre x row	Total dry matter per metre (g)	Grain weight/ 1000-seed weight (g)	metre row (g)					
	2 : 1	59.75	106.50	43.25	41.07	1175	1654	163	7306	0.99
	2 : 2	45.76	79.75	32.75	40.50	727	1052	259	6821	0.94
	3 : 1	56.75	97.75	40.25	41.70	1423	1937	123	7721	1.04
	3 : 2	53.50	84.25	35.00	41.60	1101	1516	191	7381	1.00
	4 : 1	57.25	100.25	45.00	41.20	1363	1967	118	7468	0.99
	4 : 2	54.00	100.25	40.75	42.40	1213	1572	146	7145	0.97
	58.50	106.50	40.75	39.92	1818	2921	—	—	7824	1.00
Sole wheat	—	—	—	—	—	—	—	481	6974	1.00
Sole mustard	3.42	9.03	3.32	0.66	93	159	470	14	470	—
S. Em. ±	NS	NS	NS	NS	275	472	NS	41	NS	—
C.D. at 5%										
<i>Cropping System :</i>										
Sole cropping	58.00	106.50	40.75	39.92	1818	2921	—	481	—	—
Intercropping	54.50	94.79	38.83	41.42	1167	1616	—	167	—	—
S. Em. ±	4.42	11.66	4.28	0.86	119	205	—	18	—	—
C. D. at 5%	NS	NS	NS	NS	251	431	—	37	—	—
<i>Wheat row proportions (W):</i>										
2	52.75	93.12	38.00	40.78	951	1353	—	211	—	—
3	55.12	91.00	37.62	41.66	1262	1726	—	157	—	—
4	55.62	100.25	40.87	41.81	1288	1769	—	132	—	—
S. Em. ±	2.42	6.39	2.35	0.47	65	112	—	10	—	—
C.D. at 5%	NS	NS	NS	NS	194	334	—	29	—	—
<i>Mustard row proportions (M):</i>										
1	57.92	101.50	41.50	41.32	1320	1853	—	135	—	—
2	51.08	88.08	36.17	41.52	1013	1380	—	198	—	—
S.Em. ±	1.97	5.22	1.92	0.38	53	93	—	8	—	—
C.D. at 5%	5.86	NS	NS	NS	NS	172	—	24	—	—
<i>Interaction (W x M)</i>										
S. Em. ±	3.42	9.03	4.28	0.66	93	159	—	14	—	—
C.D. at 5%	NS	NS	NS	NS	NS	NS	—	NS	—	—

NOTE : Wheat grain price Rs. 3.50/kg, wheat straw price Rs. 0.50/kg and mustard grain price Rs. 14.50/kg.

Wheat and Mustard Intercropping at Different Row Proportions

under good soil moisture situation. Wheat + mustard is a popular winter season mixed cropping practice in north India. However, many experimental results revealed no monetary benefits from the system (Anon., 1979; Batra *et al.*, 1987) because of severe reduction in wheat yield. Such studies are scarce in south India. Therefore, an investigation was conducted to evaluate the mixed cropping system of wheat + mustard on medium black soils of Agricultural College Farm, Dharwad during *rabi* 1989–90.

Different row proportions of wheat and mustard (2:1, 2:2, 3:1, 3:2, 4:1 and 4:2) were sown along with sole crop as control in a randomised block design, with four replications. Wheat (cv. Kiran) and mustard (cv. RLM-514) were sown in rows 22.5 cm apart at a seed rate of 62.5 and 5 kg/ha, respectively. A uniform dose of 50:20:0 kg/ha NPK was applied at sowing when the soil moisture was optimum. One protective irrigation was provided 30 days after sowing. A rainfall of 142.2 mm was received during cropping season.

Intercropping of mustard with wheat resulted in significant reduction in wheat yield (1167 kg/ha) from that of sole crop (1818 kg/ha). The highest yield (1423 kg/ha) was recorded with 3:1 proportion followed by 4:1 proportion (1363 kg/ha). The lowest yield (727 kg/ha) was recorded in 2:2 proportion. The higher yield in wheat with 3:1 or 4:1 proportion is attributed to increased wheat population since yield attributes did not show any significant improvement. Increased yield with wider proportions was also reported from Ranchi (Gupta and Pradhan, 1988).

Conversely, the increase in mustard rows reduced the wheat yield significantly highest being 1320 kg/ha with single mustard row as against 1013 kg/ha with two rows. Though there was increase in tiller count/

metre length with increase in mustard row it was not reflected in grain weight/metre length.

Mustard yield was also influenced significantly due to intercropping and the maximum yield was noticed with 2:2 proportion since mustard formed half of the sole population. With the reduction in population of mustard, the yield decreased and lowest (118 kg/ha) was recorded with 4:1 proportion, i.e. just 20 per cent of the sole population.

The gross returns and land equivalent ratio did not show any improvement. Sole wheat recorded maximum return (Rs. 7824/ha) and thus indicated no advantage of intercropping of mustard with wheat at the proportions studied.

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