J. Farm Sci., 33(4): (452-456) 2020

RESEARCH PAPER

Nutrient management in wheat - mustard intercropping system with different row proportion

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(Received: July, 2020 ; Accepted: October, 2020)

Abstract: Field experiment was conducted at Main Agricultural Research Station, Dharwad in split plot design which comprised of four row proportion as main plots and two fertilizer levels as sub plots. The experiment was conducted to determine the effect of wheat –mustard row ratio and to find out the optimum doses of fertilizer in intercropping system on growth and yield of wheat-mustard. The treatment detail comprise of wheat-mustard in different row proportions *viz.,* 5:1, 4:1,3:1, and 4:2 and fertilizer level include 100 and 125% RDF. The results of the study revealed that significantly wheat grain yield (2,942 kg/ha) was recorded in wheat –mustard 5:1 row proportion and higher mustard seed yield (1,197 kg/ha) was recorded in wheat –mustard 4:2 row proportion . Application of 125% RDF recorded significantly higher wheat grain yield (2,742 kg/ha) and mustard seed yield (1075 kg/ha). It can be concluded that wheat-mustard in 5:1 row proportion with 125% RDF recorded significantly higher wheat equivalent yield (4746 kg/ha) and higher land equivalent ratio (1.35) as compared to other row proportions and fertilizer level.Similarly higher gross returns (₹ 1,18976) net returns (₹ 80,910) and BC ratio (3.13) were obtained in wheat-mustard 5:1 row proportion with 125% RDF.

Key words: Economics, Intercropping, Mustard, Wheat equivalent yield

Introduction

Wheat (*Triticum* aestivum) crop is the first important and strategic cereal crop for the majority of world's population. Intercropping of wheat and mustard is an age old practice in Northern India for sake of yield stability and to cater the needs of both oil and grain. Due to change in demand and price scenario of mustard seed and wheat grain, currently intercropping may be boon to produce higher yield per unit area to generate more income under specific set of conditions particularly row ratio as replacement series in wheat and mustard.

The recommended row ratio for specific area helps to utilize applied and available resources more efficiently and effectively on sustainable basis. At specific row combination of wheat-mustard higher LER and yield advantage is augumented. Mustard is sporadically raised as sprinkle crop or as mixed crop along with *rabi* crops such as wheat, barley, groundnut, lentil. Chickpea, sorghum, coriander *etc*. to meet the domestic culinary requirements in Southern parts of the country and meager attempts have been made in non traditional growing areas of Karnataka with respect to row ratio and nutrient management for particular set of environment to achieve potential yield. For obtaining higher return per unit land area intercropping appears to be one of the important aspect. Taking into consideration of the above facts, the experiment was planned to find out the optimum row ratio and fertilizer doses in wheat – mustard intercropping system.

Material and methods

Field experiment was conducted at research farm of All India Co-ordinated Wheat and Barley Improvement Project (AICW&BIP), Main Agricultural Research Station, Dharwad. Soil of the experimental site had neutral pH (7.86), electrical conductivity (0.24 dSm^{-1}), low in organic carbon and low in available N, medium in phosphorus, high in available potassium and low in available S. The experiment was laid out in split plot design which comprised of four row proportions as main plots [Wheat - Mustard (5:1), (4:1), (3:1) and (4:2)] and two fertilizer levels as sub plots [Wheat RDF 100 % and 125 %] and sole wheat and sole mustard as control.

The wheat variety 'UAS 304' and mustard vaiety 'NRCHB101' was sown at 20 cm row spacing with a seed rate of 150 kg ha^{-1} of wheat and 4 kg ha^{-1} of mustard. Wheat and mustard was sown on 23rd November 2016 and mustard was harvested on 20th February 2017 and wheat was on 23rd march 2017. The recommende dose of fertilizer of wheat 100% (RDF) is 100:75:50:40 NPKS kg/ha and 125% (RDF) is 125:93:75:62.5 NPKS kg/ha where fifty per cent of the nitrogen, full dose of phosphorus, potassium and sulphur was applied at the time of sowing and remaining nitrogen was top dressed at 30 DAS. FYM at 7.5 t/ha was applied at 3weeks before sowing and the seed treatment with *Azospirillium* 3 kg ha^{-1} was done two hours before sowing.The crop was irrigated at 15 days interval from the day of sowing. To control leaf eating caterpillar hexaconozole @ 2ml/lt was sprayed at 35 DAS and chloropyriphos @ 2ml/lt was sprayed at 60 DAS for aphid control. White rust and powdery mildew was managed by spraying with fungicide Ridomil gold@2ml/lt at 65 DAS. The mean of the five plants were used for recording growth and yield parameters. The data collected were subjected to statistical analysis as described by Gomez and Gomez (1984).

Results and discussion

Effect of row proportion on yield and yield attributes of wheat

In the present investigation, the results clearly indicated that the growth, yield and yield attributes were significantly

Table 1. Effect of row proportion and fertilizer levels on yield attributes of wheat and mustard in intercropping system

Treatment	Wheat			Mustard		
	No. of productive tillers	Grain weight per spike (g)	1,000 grain weight (g)	No. of siliqua plant^{-1}	No. of seeds siliqua^{-1}	1000 seed weight (g)
Row proportion (R)						
R_1	231.0	1.68	42.5	305.0	17.3	4.52
R_2	224.0	1.65	42.0	292.0	16.2	4.28
R_3	216.0	1.63	41.2	281.0	15.4	4.01
R_4	210.0	1.59	39.6	266.0	14.2	3.93
S.Em. ±	2.16	0.01	0.32	3.40	0.32	0.06
C.D. at 5 %	7.46	0.03	1.11	11.77	1.04	0.22
Fertilizer levels (F)						
F_1	217.0	1.62	40.1	281.0	15.0	4.13
F_2	224.0	1.66	42.5	292.0	16.5	4.40
S.Em. ±	2.45	0.01	0.77	2.54	0.46	0.07
C.D. at 5 %	7.02	0.03	2.27	7.27	1.39	0.22
Interaction (R × F)						
R_1F_1	230.0	1.66	41.4	298.0	16.6	4.57
R_1F_2	232.0	1.70	43.5	307.0	17.3	4.68
R_2F_1	221.0	1.64	41.3	287.0	15.7	4.47
R_2F_2	227.0	1.67	42.7	299.0	17.2	4.57
R_3F_1	211.0	1.61	39.8	277.0	15.0	3.90
R_3F_2	221.0	1.64	42.5	286.0	16.0	4.07
R_4F_1	205.0	1.56	37.8	261.0	13.0	3.60
R_4F_2	216.0	1.61	41.3	271.0	15.33	4.27
S.Em ±	1.49	0.07	0.63	1.98	0.90	0.31
C.D. at 5 %	NS	NS	NS	NS	NS	NS
Sole wheat	237.0	1.72	43.8	314.0	18.0	4.84
S.Em. ±	4.98	0.01	1.27	6.54	0.93	0.18
C.D. at 5 %	14.95	0.05	3.82	19.60	2.79	0.56

Row proportion (R)
Fertilizer levels (F)

R_1: Wheat - Mustard (5:1) R_2: Wheat - Mustard (4:1) F_1: 100% RDF= 100:75:50:40. N, P_2O_5, K_2O, S.kg ha^{-1}

R_3: Wheat - Mustard (3:1) R_4: Wheat - Mustard (4:2) F_2: 125 % RDF=125:93.75:62.5:40. N, P_2O_5, K_2O, S kg ha^{-1}

DAS: Days after sowing NS: Non significant

higher due to row proportion. Significantly higher wheat grain yield (2,942 kg ha^{-1}) and straw yield (5,156kg ha^{-1}) was recorded in wheat - mustard 5:1 row proportion as compared to other row proportion in intercropping system. However, it was on par with 4:1 row proportion with grain yield (2,827 kg ha^{-1}) and straw yield (5,109 kg ha^{-1}). Significantly lower yield was recorded in 4:2 row proportion (2,334 kg ha^{-1}) and straw yield (4,667 kg ha^{-1}) as compared to other row proportion in intercropping system (Table 2).

Higher grain and straw yield in (5:1) row proportion was mainly due to higher contribution by yield attributing characters *viz*., number of productive tillers square meter^{-1}(231.0m^{-2}), grain weight spike^{-1} (1.68 g) and 1000 grain weight (42.5g) as compared to other row proportion in intercropping system (Table 1). Similar findings were also reported byAli *et al*. (2000) in 6:1 row proportion of barley - mustard intercropping system.The reason for increase in yield and yield parameters mainly due to efficient utilization of available resources *viz*., space, nutrients and light compared to other row proportion in intercropping system which led to higher yield and yield attributing characters like test weight, grain weight spike^{-1}, number of productive tillers meter square^{-1}. Similar findings were also reported by Wasaya *et al*. (2013); Rajanna *et al* (2018).

Effect of fertilizer levels on yield and yield attributes of wheat in intercropping system

Application of different fertilizer levels 125 % RDF was recorded significantly higher wheat grain yield (2,724 kg ha^{-1}) and straw yield (4,973 kg ha^{-1}) as compared to 100 % RDF grain yield (2,588 kg ha^{-1}) and straw yield (4,928 kg ha^{-1}) (Table 2). Higher grain and straw yield was noticed with the application of fertilizer level 125 % RDF mainly due to higher contribution by yield attributing characters *viz*., higher number of productive tillers square meter^{-1} was recorded with the application of 125 % RDF (224.0 m^{-2}), higher grain weight spike^{-1} recorded with the application of 125 % RDF (1.66 g), higher 1000 grain weight (42.5g) (Table 1). The reason for increase in yield parameters was mainly due to efficient utilization of available resources *viz*., space, nutrients and light in intercropping system. Similar