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Performance of wheat based intercropping as influenced by row proportions under rainfed condition of kaymore plateau

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ABSTRACT: *A field experiment was conducted on various wheat based intercropping system in different row proportions under rainfed condition of Kaymore plateau at Krishi Vigyan Kendra, Deendayal Research Institute, Majhagawan, Satna in rabi season 2013 and 2014.The intercropping of wheat was done with chickpea, linseed and mustard with row proportions of 2:2, 4:2 and 6:2.The experiment was laid out in 3 replications containing 13 treatment combinations. The observations were recorded at 30,60,90 DAS and at maturity in sole as well as on intercrops. On the basis of results obtained the intercropping of wheat with chickpea proved to be superior in terms of wheat equivalent yield and economics.*

Keywords: *Economics, intercropping, row proportion, wheat equivalent yield*

I. INTRODUCTION

Wheat is a major staple food crop of India and is of paramount importance for food security of the country. It has been a staple food with the level of consumption largely unaffected by changes in its prices and the price of substitutes like rice, maize and millets. The current production of wheat in India is approximately 74 million tonnes, out of which about 91 percent is produced in six states viz. Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan and Bihar (Mishra, 2007). The productivity of wheat in irrigated conditions is plateauing out due to problems related nutrient exhaustion, salinity build up and raising water table. Therefore, attempts are needed for increasing the productivity and production of rain fed wheat in the country in general and in the state of Madhya Pradesh in particular as this state has sufficient wheat area under rain fed conditions.

Pulses and oilseeds are the main crops of rain fed area. Among pulses chickpea is grown on 2.56 million hectare with 925 Kg/ha productivity (Ali and Shiv Kumar 2007). Among oilseeds, rapeseed and mustard has a great significance and contributed a lot in increasing the total oilseed production in the country during last two decades. Madhya Pradesh is a major oilseed producing state in the country. Linseed is also an important oilseed crop grown in Madhya Pradesh particularly under rain fed conditions.

The ways of increasing production are either expansion in area or improvement in productivity. In general, there is hardly any scope to bring additional area exclusively under pulses or oilseeds or even wheat as the demand of land for other crops will continue to rise. Thus there is only way to left is improvement in productivity of crops

Besides, other techniques, intercropping systems of growing two or more crops together on the same piece of land simultaneously may play an important role particularly under rain fed situation, where risk is more in mono cropping system. Hegde (2007) also suggested that there is considerable scope to bring large area under oilseed through intercropping system. Similar case may be with pulses.

II. MATERIALS AND METHODS

The field experiment was conducted on sandy loam soil at research farm of Krishi Vigyan Kendra Majhagawan, Satna, Madhya Pradesh in two consecutive rabi seasons (2013 and 2014). The location has subtropical climate characterized by hot dry summer and cool winter. The mean annual rainfall received during the experimental year varies from 600 mm to 850 mm. The treatments consisted 3 intercropping systems viz. wheat +chick pea, wheat +linseed, wheat +mustard and three row proportions of wheat+ intercrop 2:2, 4:2,6:2 plus one control of sole wheat. Three extra treatments of sole chickpea, sole mustard and sole linseed were also included for comparison. Thus the 10 treatments of wheat based intercropping were tried in Randomized Block Design with 3 replications. The crop was sown on 19 November 2013 and 14 November 2014. The seed rate of intercrops was decided according to row proportions. Weeding was done to conserve soil moisture through dust mulch created by hand weeding after one month of sowing during both years. Thinning operation was adopted in linseed and mustard crop. The crop was harvested on 22.03.2014 and 20.03.2014.

III. RESULTS AND DISCUSSION

Yield

Among intercroppings, chickpea produced significantly highest and mustard produced significantly lowest grain and straw yields of wheat (Table -1), these yields are attributed to yield attributes and growth characters of wheat which also behaved in a similar manner under different intercropping system. Chickpea being dwarf statured did not cause much competition for space and solar radiation, and being legume provided some of the symbiotic N for wheat utilization, which ultimately produced higher wheat yield than other intercroppings (Tomar et al, 1997). Under row proportions lowest wheat yield recorded in 2:2 row ratio with mustard intercrop (Table-1). The lower yield of wheat with linseed than chickpea intercropping might be due to allelopathic effect of chickpea. Reddy (2004) mentioned that allelopathic compounds can have important effects on other crop plants, when planted in association or mixtures. These results collaborate the findings of Tomar *et al* (1997).

As regards row ratio of wheat +intercrops 6:2 row ratio produced significantly highest wheat yields, while 2:2 row ratio produced significantly lowest yields (table 1).These yields are attributed directly to plant population of wheat under different row ratios and whereas under intercrops 2:2 wheat +chickpea produced maximum yield over other treatments (Table-2) it might be due to greater competition exerted by dominant mustard crop for light, space and nutrients. Greater canopy of mustard, intercepted greater part of light, thereby putting wheat crop to a disadvantage (Srivastav and Bohra, 2006). Similar results have been reported by Sharma *et al* (1987).

Wheat Equivalent Yield

Wheat equivalent yield was also computed significantly higher under the treatments of wheat+chickpea intercropping than sole wheat and other intercropping treatments (table-3). These are attributed to higher yield of both component crops because of better compatibility for resource utilization. These results confirm the findings of Singh *et al* (1992), Wheat equivalent yield increased with each wider row ratio in wheat, linseed or mustard intercropping but reduced in wheat +chickpea intercropping numerically. These findings are in collaboration with Mallik *et al* (1993),

Land equivalent ratio was recorded higher in intercropping treatments of wheat+chickpea as compared to other intercropping and sole cropping treatments (table-3).All intercropping treatments attained higher values of LER than sole crops. Higher LER in intercropping system in general and in wheat +pulses in particular has also been reported by Singh *et al* (1992). Barik *et al* (2006) reported that land equivalent yield increased with each wider row ratio in wheat, linseed or mustard intercropping but reduced in wheat +chickpea and wheat + mustard intercropping numerically.

Economics

Net income was also computed significantly higher in the intercropping treatments of wheat +chickpea than all other treatments (table-3). These results may very well supported by the findings Singh *et al* (1992.The intercropping treatment of wheat +chickpea being at par with wheat +linseed in 6:2 row ratio and with sole wheat, attained higher values of B:C ratios than all other treatments (table 3). These are attributed to higher net income in wheat +chickpea intercroppings and to combined effects of lower cost and higher income in case of wheat +linseed in 6:2 row ratio and sole wheat treatments. Findings of Singh et al (1992) and Srivastav and Bohra (2006) are in agreement to the results of present investigation in this respect.

Table -1 Grain and straw yield of wheat (q/ha) under different treatments (Pooled data for 2 years)

Treatment	Number of grains /spike	1000 grain weight(gm)	Grain yield (q/ha)	Straw yield (q/ha)
Intercropping	**Pooled**	**Pooled**	**Pooled**	**Pooled**
Wheat+chickpea	36.19	39.64	32.58	45.24
Wheat+linseed	33.64	40.91	28.36	40.05
Wheat+mustard	31.77	42.23	23.07	34.95
S.Ed.+-	0.79	0.33	0.71	0.97
C.D.(P=0.05)	1.58	0.66	1.44	1.97
Row ratios				
2:2	34.11	40.97	21.89	33.76
4:2	33.9	41.08	29.19	41.8
6:2	33.59	40.73	32.93	44.69
S.Ed.+-	0.79	0.33	0.71	0.97
C.D.(P=0.05)	NS	NS	1.44	1.97
Sole v/s intercropping				
Sole crop	32.96	41.61	39.94	50.95
Intercrop wheat	33.87	40.93	28	40.08
S.Ed.+-	1.01	0.42	0.92	1.26
C.D.(P=0.05)	NS	NS	1.86	2.54

Table- 2 Yield parameters of intercrops under different treatments (Pooled data for 2 years)

	Treatments				S.Ed.+.	C.D.(P=0.05)
Yield Parameter	Sole crop	2:2	4:2	6:2		
	Chickpea					
No. of chickpea pods	22.67	26.22	27.1	26.94	0.82	1.79
Weight of 1000-seeds (g)	158.0	160.25	160.9	160.63	2.21	NS
Grain yield	19.73	12.67	8.52	6.56	0.56	1.22
Straw yield	27.26	17.1	11.38	8.83	0.65	1.41
	Linseed					
No. of linseed capsule	28.27	31.13	30.39	29.94	0.83	1.8
Weight of 1000-seeds (g)	6.46	6.65	6.73	6.65	0.13	NS
Grain yield	12.19	6.66	4.63	3.41	0.29	0.64
Straw yield	19.71	10.3	7.08	5.28	0.45	0.97
	Mustard					
No. of Mustard siliquae	115.77	131.78	135.65	136.51	3.72	8.11
Weight of 1000-seeds (g)	4.41	4.49	4.52	4.51	0.06	NS
Grain yield	14.11	10.54	7.11	5.39	0.32	0.69
Straw yield	29.06	20.22	13.84	10.9	0.63	1.38

Table -3 Wheat equivalent yield (q/ha) and Land equivalent ratio under different treatments (Pooled data for 2 years)

Treatments	**Wheat equivalent yield(q/ha)**	**Land equivalent ratio**	**Net income (000 Rs/ha)**	**B:C ratio**
Sole wheat	39.94	1	36.882	3.45
Wheat+chickpea(2:2)	46.04	1.36	42.429	3.64
Wheat+linseed(2:2)	35.86	1.08	30.52	2.84
Wheat+mustard(2:2)	35.14	1.16	30.203	2.79
Wheat+chickpea(4:2)	44.61	1.27	41.232	3.59
Wheat+linseed(4:2)	39.83	1.12	35.687	3.31
Wheat+mustard(4:2)	37.04	1.11	33.119	3.06
Wheat+chickpea(6:2)	44.16	1.23	40.718	3.59
Wheat+linseed(6:2)	41.76	1.14	37.952	3.5
Wheat+mustard(6:2)	38.5	1.1	25.07	3.24
S.Ed.+-	1.92	0.06	1.914	0.17
C.D.(P=0.05)	3.76	0.11	3.752	0.33
Sole intercrop				
Chickpea	27.62	1	19.146	1.71
Linseed	26.82	1	19.366	2.09
Mustard	25.4	1	19.589	2.15

IV. CONCLUSION

It could be concluded from the findings of the above experiment that the intercropping and row proportions of wheat +chickpea with 2:2 was found to be suitable for higher production, wheat equivalent yield and economics for rainfed areas . The maximum yield of wheat was observed in wheat +chickpea (Table-1). Where as maximum wheat equivalent yield, land equivalent ratio, net return and B:C recorded under wheat +chickpea with 2:2 row ratio (Table-3).

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