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Effect of intercropping of groundnut and cowpea with mustard (*Brassica juncea* L.)” on biomass production and nutrient balance under konkan condition

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Abstract

A field experiment on “Intercropping of groundnut and cowpea with mustard (*Brassica juncea* L.)” was conducted during *rabi*, 2018-19 at Agronomy Farm, College of Agriculture, Dapoli (M.S.) with objectives to quantify the effect of intercropping on main as well as intercrops in terms of their growth, yield, quality, N, P, K uptake and economics of intercropping systems. Conclusionary finding are abstracted below. The intercrops like groundnut and cowpea being leguminous crops, improved the growth performance of mustard. However, growth performance of both the intercrops was better under their sole stands. The yield attributes and yield of mustard was improved due to intercropping system. In general, within the intercropping systems, when mustard was grown with groundnut, yield performance of mustard was better, followed by mustard + cowpea. Maximum values of nitrogen, phosphorous and potassium content in grain and straw of mustard and quality parameters were recorded in case of mustard + groundnut in 3:1 proportion. However, total uptake of these nutrients was higher at sole cropping. For the production of higher total biomass, mustard equivalent yield (MEY) and to earn more net profit, mustard + groundnut intercropping system should followed in 1:1 row proportion.

Keywords: Intercropping, Nutrient Balance, Biomass Production and Konkan

Introduction

Oilseed constitute the second largest agriculture commodity in India after cereals accounting for nearly 6 per cent of gross national product and 10 per cent of the value of all agriculture products. Despite the fact that India is one of the leading oilseeds producing countries in the world, it is not able to meet the edible oil requirement for its vast population. In India, vegetable oil is mainly derived from nine oilseeds among which mustard ranks second to groundnut in area and production. It is mostly grown in northern or north-eastern region of India either sole or intercropped with wheat, gram or pea. Among the oilseeds, rapeseed-mustard group occupies prominent position in the country during winter season (GOI, 2011). Intercropping is recommended to be used in many parts of the world for food or fibres productions, because of its overall high productivity, effective control of pests and diseases, good ecological services and economic profitability. In an intercropping system, there are often two or more crop species grown in the same field for a certain period of time, even though the crops are not necessarily sown or harvested simultaneously. In practice, most intercropping systems involve only two crops, as inclusion of more crops results in higher labour costs. Mostly, intercropping is practiced with the aim of maximum plant competition rather than plant competition for maximum crop yield.

Keeping the in view importance of the intercropping system, the proposed research entitled “Intercropping of groundnut and cowpea with mustard (*Brassica juncea* L. Czern. & Coss.)” Was conducted at Agronomy Farm, College of Agriculture, Dapoli during *rabi* season of 2018

Methods and Material

The present investigation entitled “Intercropping of groundnut and cowpea with mustard (*Brassica juncea* L.)” was carried out during *rabi* season of 2018 at Agronomy Farm, College of Agriculture Dapoli. The results of the present investigation analyzed using Randomized Block Design are discussed critically under this chapter.

In the present investigation mustard (Varuna) was grown with groundnut (Konkan Tapora) and cowpea (Konkan Sadabhar) in different intercropping proportions on row basis of 1:1, 1:2, 1:3, 2:1 and 3:1.

This was a replacement series of intercropping system, wherein as per row proportion the lines of mustard were replaced by either groundnut or cowpea. The main/base crop (mustard) and two intercrops (groundnut and cowpea) were planted at 30 X 15 cm spacing. Sole crop treatments of all the crops were also included to study the comparative performance of the planting patterns. In case of sole crops as well as in case of intercropping system, crops were fertilized with their respective recommended doses, i.e. mustard with 90 kg N + 45 kg P₂O₅ per hectare, groundnut 25 kg N + 50 kg P₂O₅ per hectare, and cowpea 25 kg N + 50 kg P₂O₅ per hectare. In all, total thirteen treatments were tested in Randomized Block Design with three replications. The other common package of practices was followed time to time and periodical growth observations were recorded and economics were calculated.

Results

1.1 Total biomass production (q/ha)

Data pertaining to the total biomass production in quintals per hectare are presented in Table 1. The data were not statistically analyzed; hence, inferences were drawn from mean values. Mustard + groundnut under 1:1 ratio recorded the highest biomass production per hectare than all the treatments. In different planting patterns, 1:1 ratio (mustard + groundnut) produced total biomass which was followed by 3:1 ratio (mustard + groundnut). Among different intercropping system, mustard + groundnut recorded higher total biomass under each ratio than mustard + cowpea intercropping system. Mahadkar (1983) [6], Bandyopadhyay and De (1986), Jat and Ahlawat (2009), Mehta (2010), Choudhuri and Jana (2015).

Table 1. Total biomass production (q/ha) as affected by various treatments

Treatments	Total biomass
Sole mustard	62.67
Sole groundnut	61.16
Sole cowpea	39.83
Mustard + groundnut (1:1)	73.34 (39.65+33.69)
Mustard + cowpea (1:1)	61.31 (38.41+22.90)
Mustard + groundnut (1:2)	63.92 (22.73+41.19)
Mustard + cowpea (1:2)	49.4 (22.62+26.78)
Mustard + groundnut (1:3)	63.92 (17.22+46.7)
Mustard + cowpea (1:3)	47.67 (16.85+30.82)
Mustard + groundnut (2:1)	67.05 (44.10+22.95)
Mustard + cowpea (2:1)	59.41 (43.54+15.87)
Mustard + groundnut (3:1)	68.67 (50.97+17.7)
Mustard + cowpea (3:1)	63.24 (50.19+13.05)

3. Nitrogen and phosphorus status studies

3.1 Nitrogen status studies

Data pertaining to the mean values of initial available nitrogen from soil, added nitrogen, uptake by plants, expected

balance, actual balance of nitrogen in soil (kg ha⁻¹), net loss or gain of soil nitrogen are presented in Table 2. The data were not statistically analyzed therefore, the inferences were drawn from the mean values.

Data presented in the Table 3 indicated that among the sole crops, mustard, groundnut and cowpea recorded addition of nitrogen ranging from 22.5 kg ha⁻¹ to 90 kg ha⁻¹. However, sole mustard showed net loss of soil nitrogen (-0.46 kg ha⁻¹) and the higher net gain of nitrogen is obtain in sole groundnut (67.72 kg ha⁻¹). Among the different intercropping system, there was net gain in soil nitrogen ranging from 6.92 kg ha⁻¹ to 28.97 kg ha⁻¹ under all planting ratios. The net gain of nitrogen increased with subsequent increase in mustard proportion in the intercropping system. Among the different intercropping system mustard + groundnut under 3:1 ratio showed the higher net gain of nitrogen (28.87 kg ha⁻¹) while, mustard + cowpea under 1:3 ratio recorded less net gain of nitrogen (6.52 kg ha⁻¹) under all the intercropping system. Mahadkar and Khanvilkar (1988), Thorat *et al.* (1986), More (1990), Choudhuri and Jana (2015) and Jakhar *et al.* (2015).

3.2 Phosphorus status studies:

Data pertaining to the mean values of initial available phosphorus from soil, added phosphorus, and uptake by plants, expected balance, actual balance of phosphorus in soil (kg ha⁻¹), net loss or gain of soil phosphorus are presented in Table 4. The data were not statistically analyzed therefore, the inferences were drawn from the mean values.

Data presented in the Table 4 Indicated that among the sole crops, mustard, groundnut and cowpea recorded addition of phosphorus ranging from 11.25 kg ha⁻¹ to 50 kg ha⁻¹. However, sole mustard showed net loss of soil phosphorus (-28.89 kg ha⁻¹) and the higher net loss of phosphorus is obtain in sole groundnut (-42.29 kg ha⁻¹). Among the different intercropping system, there was net loss in soil phosphorus ranging from -6.41 kg ha⁻¹ to -19.19 kg ha⁻¹ under all planting ratios. The net loss of phosphorus increased with subsequent increase in mustard proportion in the intercropping system. Among the different intercropping system mustard + cowpea under 3:1 ratio showed the higher net loss of phosphorus (-19.19 kg ha⁻¹) while, mustard + groundnut under 1:3 ratio recorded less net loss of phosphorus (-6.41 kg ha⁻¹) under all the intercropping system.

Conclusion

From the present study of experiment following conclusions can be drawn, Highest accumulation of biomass was recorded in mustard + groundnut in 1:1 proportion and calculated gain of N is recorded in mustard + groundnut in 3:1 row proportion. The net loss of phosphorus increased with subsequent increase in mustard proportion in the intercropping system.

Table 2: Balance sheet of available N (kg ha⁻¹) as influenced by the different treatment combinations after harvest of mustard and intercrops

Treatments	Initial available soil N	Addition of N through fertilizers	Total available N	Removal of N by crops	Expected balance of available N	Actual balance of available N	Calculated gain/ loss of available N
1	2	3	(2+3) = 4	5	(4-5) = 6	7	(7-6) = 8
sole mustard	241.47	90	331.47	89.81	241.66	241.23	-0.43
sole groundnut	241.47	25	266.47	137.82	128.65	196.37	67.72
sole cowpea	241.47	25	266.47	85.93	180.54	215.94	35.4
musatrd + undnut (1:1)	241.47	45	286.47	65.35	221.12	245.12	24
musatrd + cowpea (1:1)	241.47	45	286.47	62.11	224.36	245.07	20.71
mustard + undnut (1:2)	241.47	30	271.47	38.06	233.41	244.90	11.49

mustard + cowpea (1:2)	241.47	30	271.47	37.39	234.08	244.65	10.57
mustard + undnut (1:3)	241.47	22.5	263.97	27.87	236.1	244.50	8.4
mustard + cowpea (1:3)	241.47	22.5	263.97	27.29	236.68	243.60	6.92
mustard + groundnut (2:1)	241.47	60	301.47	75.53	225.94	247.46	21.52
mustard + cowpea (2:1)	241.47	60	301.47	74.01	227.46	246.74	19.28
mustard + roundnut (3:1)	241.47	67.5	308.97	88.13	220.84	249.81	28.97
mustard + cowpea (3:1)	241.47	67.5	308.97	85.53	223.44	248.88	25.44

Table 3: Balance sheet of available P (kg ha⁻¹) as influenced by the different treatment combinations after harvest of mustard and intercrops

Treatments	Initial available N	Add P through ferti	Total available P	Removal of P by crops	Expected balance of available P	Actual balance of available P	Calculated gain of available P
1	2	3	(2+3) = 4	5	(4-5) = 6	7	(7-6) = 8
sole mustard	10.01	45	55.01	16.04	38.97	10.08	-28.89
sole groundnut	10.01	50	60.01	7.078	52.932	10.64	-42.29
sole cowpea	10.01	50	60.01	16.88	43.13	10.59	-32.54
musatrd + groundnut (1:1)	10.01	22.5	32.51	10.31	22.2	10.58	-11.62
musatrd + cowpea (1:1)	10.01	22.5	32.51	9.7	22.81	10.55	-12.26
mustard + groundnut (1:2)	10.01	15	25.01	5.99	19.02	10.54	-8.48
mustard + cowpea (1:2)	10.01	15	25.01	5.86	19.15	10.47	-8.68
mustard + groundnut (1:3)	10.01	11.25	21.26	4.39	16.87	10.46	-6.41
mustard + cowpea (1:3)	10.01	11.25	21.26	4.32	16.94	10.39	-6.55
mustard + groundnut (2:1)	10.01	30	40.01	12.26	27.75	10.79	-16.96
mustard + cowpea (2:1)	10.01	30	40.01	11.8	28.21	10.65	-17.56
mustard + groundnut (3:1)	10.01	33.75	43.76	14.32	29.44	11.16	-18.28
mustard + cowpea (3:1)	10.01	33.75	43.76	13.75	30.01	10.82	-19.19

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