International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(5): 241-244

Received: 05-05-2017
Accepted: 06-06-2017

Gopali Yadav
S.K.N. College of Agriculture (Sri Karan Narendra Agriculture University) Jobner, Rajasthan, India

AC Shivran
S.K.N. College of Agriculture (Sri Karan Narendra Agriculture University) Jobner, Rajasthan, India

VK Yadav
Rajasthan College of Agriculture (MPUAT) Udaipur, Rajasthan, India

M Yadav
S.K.N. College of Agriculture (Sri Karan Narendra Agriculture University) Jobner, Rajasthan, India

K Yadav
S.K.N. College of Agriculture (Sri Karan Narendra Agriculture University) Jobner, Rajasthan, India

I Mohammad
S.K.N. College of Agriculture (Sri Karan Narendra Agriculture University) Jobner, Rajasthan, India

Correspondence
Gopali Yadav
S.K.N. College of Agriculture (Sri Karan Narendra Agriculture University) Jobner, Rajasthan, India

Effect of planting pattern and on growth, yield and nutrient uptake by *kharif* integrated nutrient management Pulses under semi-arid region of Rajasthan

Gopali Yadav, AC Shivran, VK Yadav, M Yadav, K Yadav and I Mohammad

Abstract
An investigation was carried out during *kharif*, 2015 under rainfed condition to study the feasibility and economic viability of *kharif* Pulses under different intercropping systems and integrated nutrient management at S.K.N. College of Agriculture, Jobner (Jaipur). Among different intercropping systems, sole crop of mungbean and mothbean recorded significantly more growth and yield attributes except plant height which recorded in mungbean + sesame (2:1) PR ratio and mothbean+sesame (2:1) PR ratio. Sole planting of *kharif* Pulses gave significantly maximum seed and straw yields, whereas, mungeban equivalent yield and net returns were observed under mungbean + sesame (2:1) PR ratio. The concentration of N, P and K and its total uptake and protein content were observed significantly under sole crop of mungbean and mothbean over rest of systems. Application of 50% RDF through fertilizer + 50% RDF through vermicompost recorded significantly higher growth and yield attributes and yield, mothbean equivalent yield and net returns and remained at par with application of 75% RDF through fertilizer + 25% RDF through vermicompost. A significant increase in N, P and K concentration and its total uptake observed Application of 50% RDF through fertilizer + 50% RDF through vermicompost.

Keywords: intercropping, mungbean, mothbean, nutrient uptake, planting pattern, integrated nutrient management

Introduction

Intercropping and mixed cropping is predominant in the arid and semi-arid tropics. Greengram [*Vigna radiata* (L.) Wilczek] and mothbean (*Vigna aconitifolia* (Jacq.) Marechal*)*, a major rainfed crop in arid zone of Rajasthan, is mostly grown with clusterbean and sesame. Plant population and spatial arrangement in intercropping have important bearing on productivity of component crops. Mungbean and mothbean, being a short duration crop, fits well in sequential and intercropping systems for stepping up the production. Short supply of pulses and oilseeds has forced our country to import pulses and edible oil. Under these circumstances intercropping of pulses and oilseeds may be a feasible and viable option to augment per unit area productivity of these crops through spatial intensification which could be comparable with other higher productive crops (Meena *et al.* 2008) [4]. Among the various technologies developed for rainfed agriculture, intercropping is one of the most important techniques which embody growing of crop under different plant geometry. With the release of early maturing and diverse crop varieties it is proved beyond doubt that such a system, when based on sound production principles, will provide greater stability, productivity and profitability. The system of intercropping not only improves the yield and returns but also reduces the risk of complete crop failure as compare to the sole cropping system (Rao and Singh, 1990) [10]. In India fertilizer is one of the costliest inputs in crop production. Thus, with the rising cost of fertilizers, the potential of using legumes to increase soil nitrogen becomes increasingly attractive. Lipmann (1913) [3] was the first to suggest that soluble nitrogenize compounds were utilized by adjoining porous root walls of non-legume when grown in association with legumes. Legumes offer excellent compatible combination for mixing with oil seeds to minimize the competition and to confer a symbiotic association to achieve the prim aim of maximizing available resources. Hence, the practice of intercropping of sesame with *kharif* pulses of rainy season seems to be a good position to economize the applied nutrient. The integration of chemical fertilizers with organic manures have been found to be quite promising not only in maintaining higher productivity but also providing greater stability in crop production (Nambiar and Abrol, 1992) [6]. Vermicompost has been advocated as a good source of organic manure for use in integrated management practices for field crops. A judicious combination of organic and inorganic fertilizers can maintain long term fertility and sustain higher productivity of crops. Considering the low nutrient status of soil (particularly N and P as well as organic matter) there is need of integrated nutrient management (organic and inorganic fertilizer), in a balanced proportion than which either alone or in combination can increase and sustainable growth and yield of crops. Therefore, the present study aimed to determine the compatibility of sesame for intercropping with *kharif* pulses under varying level of fertilizer and vermicompost.

Materials and Methods

A field experiment was conducted during *kharif*, 2015 at S.K.N. College of Agriculture, Jobner (Jaipur). The soil was loamy sand in texture, alkaline in reaction (pH 8.2), low in organic carbon (0.14%), available nitrogen (130 kg/ha), available phosphorus (16.52 kg P_2O_5/ha) and medium in potassium (151.8 kg K_2O/ha) content. The experiment consisted of four intercropping systems *viz.,* [sole mungbean, sole mothbean, sole sesame, mungbean + sesame in 2:1 paired row ratio and mothbean + sesame in 2:1 paired row ratio] and four treatments of integrated nutrient management (100 % RDF through fertilizer, 75% RDF through fertilizer + 25% RDF through vermicompost, 50% RDF through fertilizer + 50% RDF through vermicompost and 100% RDF through vermicompost) was laid out in Randomized Block Design with three replications. The experimental crops were sown in lines 30 cm apart for sole crops. Under intercropping after pairing two rows of mothbean at 20 cm leaving the space of 40 cm in between pairs, one row of sesame was sown in 2:1 paired row intercropping system. The intra row spacing of 10 cm for both crops was maintained after the thinning. The mugbean variety ‘RMG-492’, mothbean ‘RMO-257’ and sesame ‘RT-46’ were used. A common recommended dose of fertilizes (20 kg N and 40 kg P_2O_5/ha) was uniformly applied to all the plots through urea, DAP and vermicompost, respectively before sowing in respective plots as per treatments. The crop was sown on 5th July 2015 and harvested on the 20 September 2015. Cost of cultivation was calculated by taking current market prices of inputs, while gross returns were obtained by multiplying seed and straw yields with market prices. Net returns were calculated by deducting cost of cultivation from gross returns. The N, P and K uptake and their available status in soil were estimated by using standard procedures. The yields further used for computation of LER as suggested by Willey (1979) [12]. Data was statistically analysed by the procedure described by Panse and Sukhatme (1985) [7]. Obersation on yield of mungbean and mothbean was recorded from area of net plots harvested. The mungbean equivalent yield was calculated by converting the seed yield of mothbean and sesame into mungbean yield on the basis of existing market prices of the crops.

Results and Discussion

Growth parameters

In the present investigation, plant height of mungbean and mothbean significantly increased when grown with sesame and maximum plant height recorded in 2:1 PR ratio over sole crop at 40 DAS and at harvest, while maximum dry matter accumulation observed under sole crop. The increase in plant height due to increased competition between plants for sunlight in paired row planting of mothbean. Application of 50 % RDF through fertilizer + 50% RDF through vermicompost significantly improved plant height and dry matter accumulation at different growth stages and remained at par with application of 75% RDF through fertilizer + 25% RDF through vermicompost.

Yield

The yield attributes (number of pods/plant and number of seeds/pod) and yields (seed and straw) of mungbean and mothbean were significantly higher in sole crop as compared to intercropping systems. Among the row ratios mungbean + sesame and mothbean + sesame grown in 2:1 paired row ratio recorded significantly maximum seed and straw yields, while maximum mungbean equivalent yield observed in mungbean + sesame and maximum LER observed in 2:1 paired row ratio. The reduction in yield in all row ratios over sole crop was primarily due to low plant population of mungbean and mothbean in intercropping systems. Reduction in yield of *kharif* pulses might also be due to competition between the component crops for sharing of nutrients, light and water by intercrop. These results are in close conformity with those of Prajapat *et al.* (2011) [8]. Application of 50 % RDF through fertilizer + 50% RDF through vermicompost significantly improved number of seeds/pod and seed and straw yields, mungbean equivalent yield and remained at par with application of 75% RDF through fertilizer + 25% RDF through vermicompost. The efficacy of inorganic fertilizer is much pronounced when it is combined with organic manure. The increased vegetative growth and the balanced C:N ratio might have increased the synthesis of carbohydrates, which ultimately promoted yield. The probable reason could be efficient and greater partitioning of metabolites and adequate transformation of nutrients to developing plant structures. As a result, almost all yield attributes of crops resulted into significant improvement due to organic manures and fertilizer in combination. The present trend of increase in yield is in close conformity with the findings of Jaishankar and Wahab (2005) [2], and Choudhary *et al*. (2011) [1] and Shivran *et al*. (2015) [11].

Nutrient uptake and quality parameters

Intercropping systems differed in concentration, uptake by seed and straw and total uptake of N, P and K and protein content in seed of mungbean and mothbean. Sole crop of pulses recorded significantly higher concentration, uptake by seed and straw and total uptake of N, P and K and protein content in seed of mungbean and mothbean as compared to 2:1 PR ratios. The higher total N, P and K uptake under sole crop as compared to intercropping systems was primarily due to increased seed yield under sole crop. Meena *et al.* (2008) [4] also reported significantly higher uptake of total N by sole clusterbean and sesame. Application of 50% RDF through fertilizer + 50% RDF through vermicompost significantly increased the nitrogen and potessium concentration in seed and in straw of both the crops (mungbean and mothbean), total uptake of N, P and K and protein content in seed of mungean and mothbean and P concentration in seed and straw of mungbean and seed of mothbean However, it remained at par with application of 75% RDF through fertilizer + 25% RDF through vermicompost. This might also be due to improved nutritional environment in the rhizosphere as well as its utilization in the plant system leading to enhanced translocation of N, P and K to reproductive structures *viz*., pods, seeds and other plant parts. The increase in these parameters due to N, P and K fertilization led to an increased uptake of nutrients in the present study (Rana *et al*. (2014) [9]

Economics

Comparison made amongst varying intercropping systems revealed numerically higher net returns were obtained with The mungbean + sesame 2:1 PR ratio gave significantly higher net returns (`78656/ha) followed by sole mungbean (□ 68300/ha), as compared to sole mothbean, sole sesame and mothbean + sesame 2:1 PR ratio. Application of 50% RDF through fertilizer + 50% RDF through vermicompost fetched significantly maximum net returns (`55803/ha) and it remained at par with application of 75% RDF through fertilizer + 25% RDF through vermicompost. This might be due to higher seed and straw yields and proportionately higher additional income compared to cost involved which led to significantly more net returns than other treatments. These findings are in accordance with the results reported by Kumar *et al*. (2013) [5] and Shivran *et al*. (2015) [11] who reported that maximum net returns were obtained under application of inorganic and organic manures in combination.

Table 1: Effect of planting pattern and integrated nutrient management on growth and yield of *Kharif* pulses

	MUNGBEAN						MOTHBEAN								
Treatment	Plant height (cm)		Dry matter accumulation (g/meter row)		Yield (Kg/ha)		Plant height (cm)		Dry matter accumulation (g/meter row)		Yield (Kg/ha)		MEY (kg/ha)	LER	Net returns (Rs/ha)
	40 DAS	At harvest	40 DAS	At harvest	Seed yield	Straw yield	40 DAS	At harvest	40 DAS	At harvest	Seed yield	Straw yield			
A. Intercropping															
MG sole	24.30	51.80	37.20	116.33	1161	2403	-	-	-	-	-	-	1161	1.00	68300
MT sole	-	-	-	-	-	-	13.88	26.26	35.19	105.12	888	1800	678	1.00	30306
MG + S (2:1) PR	27.20	54.50	33.15	105.96	965	1919	-	-	-	-	-	-	1316	1.33	78656
MT + S (2:1)PR	-	-	-	-	-	-	14.40	27.31	31.12	94.21	721	1435	920	1.34	47829
SEm ±	0.62	1.07	0.76	2.17	19	30	0.16	0.32	0.73	1.91	15	35	19	0.02	920
CD (P=0.05)	1.88	NS	2.30	6.58	56	90	0.49	0.98	2.22	5.79	45	105	55	0.06	2635
B. Integrated nutrient management															
100% RDF (fertilizer)	24.04	50.36	33.15	105.47	1030	2105	13.44	25.23	32.53	95.13	779	1567	927	1.13	51692
75% RDF (fertilizer) + 25% RDF (VC)	26.72	55.26	36.62	116.17	1098	2229	14.98	27.99	34.55	104.03	827	1654	988	1.13	54938
50% RDF (fertilizer) + 50% RDF (VC)	28.74	56.98	38.82	119.25	1133	2307	15.68	29.33	35.82	107.65	860	1749	1018	1.13	55803
100% RDF (VC)	23.50	50.00	32.11	103.69	991	2003	12.46	24.59	29.72	91.85	751	1500	887	1.13	42492
SEm±	0.88	1.52	1.07	3.07	26	42	0.23	0.46	1.04	2.70	21	49	17	0.02	823
CD (P=0.05)	2.66	4.60	3.25	9.30	80	128	0.69	1.38	3.14	8.19	64	149	49	NS	2357

Table 2: Effect of planting pattern and integrated nutrient management on nutrient concentration and uptake of *Kharif* pulses

	Mungbean										Mothbean									
Treatment	N concentration (%)		Total N uptake (kg/ha	Protein content (%)	P concentration (%)		Total P uptake (kg/ha	K concentration (%)		Total K uptake (kg/ha)	N concentration (%)		Total N uptake (kg/ha	Protein content (%)	P concentration (%)		Total P uptake (kg/ha)	K concentration (%)		Total K uptake (kg/ha)
	Seed	Straw			Seed	Straw		Seed	Straw		Seed	Straw			Seed	Straw		Seed	Straw	
A. Intercropping																				
MG sole	3.941	1.261	76.44	24.63	0.543	0.260	12.62	0.960	1.290	42.24	-	-	-	-	-	-	-	-	-	-
MT sole	-	-	-	-	-	-	-	-	-	-	3.701	1.992	69.04	23.13	0.456	0.268	8.909	0.786	1.485	33.79
MG + S (2:1) PR	3.564	1.214	57.96	22.28	0.398	0.180	7.35	0.780	1.210	30.81	-	-	-	-	-	-	-	-	-	-
MT + S (2:1)PR	-	-	-	-	-	-	-	-	-	-	3.366	1.860	51.19	21.04	0.418	0.232	6.381	0.011	1.373	24.83
SEm ±	0.056	0.024	2.04	0.35	0.016	0.014	0.47	0.013	0.016	0.70	0.055	0.051	2.01	0.34	0.009	0.006	0.242	0.035	0.018	0.72
CD (P=0.05)	0.171	NS	6.17	1.07	0.049	0.043	1.42	0.041	0.048	2.11	0.166	NS	6.08	1.04	0.028	0.017	0.734	0.017	0.053	2.17
B. Integrated nutrient																				

management																				
100% RDF (fertilizer)	3.640	1.210	63.25	22.75	0.438	0.193	8.72	0.840	1.220	34.50	3.465	1.870	56.60	21.66	0.425	0.243	7.171	0.724	1.403	27.77
75% RDF (fertilizer) + 25% RDF (VC)	3.910	1.270	71.54	24.44	0.498	0.243	11.08	0.900	1.270	38.43	3.634	1.992	63.30	22.71	0.461	0.261	8.192	0.769	1.452	30.54
50% RDF (fertilizer) + 50% RDF (VC)	4.050	1.340	77.22	25.31	0.528	0.280	12.66	0.930	1.310	41.00	3.754	2.112	69.61	23.46	0.474	0.266	8.798	0.792	1.492	33.11
100% RDF (VC)	3.410	1.130	56.77	21.31	0.418	0.163	7.48	0.810	1.200	32.18	3.281	1.730	50.96	20.51	0.388	0.230	6.419	0.683	1.370	25.82
SEm±	0.080	0.034	2.88	0.50	0.023	0.020	0.66	0.019	0.022	0.99	0.077	0.072	2.84	0.48	0.013	0.008	0.342	0.016	0.025	1.01
CD (P=0.05)	0.242	0.104	8.73	1.51	0.069	0.061	2.01	0.058	0.068	2.99	0.234	0.218	8.60	1.46	0.039	NS	1.039	0.049	0.075	3.08

References

1. Choudhary HR, Sharma OP, Yadav LR, Choudhary GL. Effect of organic sources and chemical fertilizers on productivity of mungbean. Journal of Food Legumes, 2011; 24(4):326-328.
2. Jaishanker S, Wahab K. Effect of integrated nutrient management on growth, yield component and of sesame. Sesame and Safflower Newsletter, 2005.
3. Lipman JG. A further discussion on certain methods used in the study of associated growth of legumes and non-legumes. Journal of American Society of Agronomy. 1913; 5:70-72.
4. Meena SL, Shamsudheen M, Dayal, Devi. Impact of row ratio and nutrient management on performance of clusterbean (*Cyamopsis tetragonoloba*) +sesame (*Sesamum indicum*) intercropping system. Indian Journal of Agronomy. 2008; 53(4):284-289.
5. Kumar R, Pandey DS, Singh VP, Pandey D. Growth, yield and quality of wheat (*Triticum aestivum*) as influenced by organic sources of nitrogen nutrition. *Indian Journal of Agronomy*. 2013; 58(3):334-339.
6. Nambiar KKM, Abrol IP. Long term fertilizer experiments in India – An Overview Fertilizer News. 1992; 34:11-26.
7. Panse VG, Sukhatme PV. Statistical methods for Agricultural workers. ICAR Publication, New Delhi, 1985.
8. Prajapat K, Shivran AC, Yadav LR, Choudhary GL. Growth, production potential and economics of mungbean as influenced by intercropping systems and sulphur levels. Journal of Food Legumes. 2011; 24(4):330-331.
9. Rana R, Badiyala D. Effect of integrated nutrient management on seed yield, quality and nutrient uptake of soybean (*Glycine max*) under mid hill conditions of Himachal Pradesh. Indian Journal of Agronomy. 2014; 59(4):641-645
10. Rao MR, Singh M. Productivity and risk evolution in contrasting intercropping systems. Field Crop Research. 1990; 23:279-293.
11. Shivran AC, Jat NL. Integrated nutrient management influenced growth, yield and economics of fennel (*Foeniculum vulgare*) under semi arid conditions. Indian Journal of Agronomy. 2015; 60(3):318-323.
12. Willey RW. Intercropping: its importance and research I. Competition and yield advantages. Field Crops Abstract. 1979; 52:181-193.