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EFFECT OF INTEGRATED CROP MANAGEMENT PRACTICES ON GROWTH AND YIELD OF RAJMASH (*Phaseolus vulgaris* L.)

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Abstract: A field experiment was carried out during three consecutive seasons of *Rabi* 2013-14, 2014-15 and 2015-16 at Pulses research station, S.D. Agricultural University, Sardarkrushinagar, Gujarat to study the effect of integrated crop management in rajmash. The different weed management, pest management and nutrient management treatment effect was measured on seed yield of rajmash, among them application of 100 kg N + 40 kg P_2O_5/ha along with seed inoculation with *Rhizobium* + PSB (250 g/8 kg seed) and weed control with Pendimethalin @ 1 kg /ha followed by one hand weeding at 30 DAS performed better and produced higher seed yield of rajmash. Combined application of INM + IWM secured the highest net returns of Rs. 48617 /ha with highest benefit cost ratio of 1.71 followed by INM + IWM + IPM with net return of Rs. 40258/ha.
Keywords: Rajmash, IWM, INM, IPM, Seed yield.

INTRODUCTION

Cultivation of pulses is gaining importance all over the World due to their increasing demand and high market value. In India, pulses are grown mostly on marginal and sub-marginal lands without proper inputs occupying first in pulse production with 23 Million hectare. Among pulse crop, rajmash (*Phaseolus vulgaris* L.) is becoming popular with the farmers due to its high profit in comparison to other pulses and unlike other pulse crop. Rajmash is a highly protein rich stable cash crop. Rajmash (*Phaseolus vulgaris* L.) belongs to the Leguminasae family and is also known as French bean, kidney bean, common bean. Rajmash is consumed as green vegetables as well as grain pulse. For vegetable purpose, round podded type with more flesh and less string is preferred. Among all the beans, it is the most extensively grown bean because of its short duration and nutritive value (Longkumar and Singh, 2016). It has very high nutritional value containing 20.69 to 25.81% crude protein, 1.72% fats, 72.42% carbohydrates and 5.83 mg of iron. Moreover, it has good amount of ash content, crude fiber, and total sugars. It is rich in amino acids like tryptophan, methionine, and some phenolic compounds like tannin and polyphenol oxidase (Singh *et al*, 2014).

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Integrated nutrient management plays a key role in sustaining soil fertility and crop productivity as well as minimizing the risk of climate change. Improper amount of nutrient supply in crop cause malnourishing or under-nourishing that reduces the production of crop, even all the practices are adopted in appropriate manner (Abrol *et al*, 2006). Thus judicious combination of organics and chemical fertilizers helps to maintain soil productivity; further sub optimal use of fertilizer nutrients, particularly, nitrogen and phosphorus appears to be most important (Mukherjee, 2016). The initial growth rate of French bean is slow and the inter-spaces are infested with weeds. The losses in general, due to weed depend on composition of weed flora, extent of infestation and the crop canopy, but it has been estimated that losses due to weeds alone can reduce the yield to the tune of 20-60 per cent. To keep the weeds within a desirable

limit, various methods which include physical, mechanical, chemical and biological are in use and among these methods, control of weeds through herbicide use is not only efficient method but is easily adopted by farmers. (Panotra *et al*, 2012). Therefore it becomes imperative to evaluate the different crop management practices which are safe to the crop and at the same time provide effective and higher production. The increase in yield owed to increase in yield attributes due to effective weed control. In this aspect a field experiment was conducted with the objective to find out effective crop management techniques using Nutrient management with fertilizer and bio-fertilizer, weed management with mechanical and chemical control and chemical pest control for better growth and higher yield in Rajmash under North Gujarat conditions.

MATERIAL AND METHODS

The present investigation was conducted at Pulses Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat during *rabi* season of 2013-14, 2014-15 and 2015-16. The soil of experimental site was loamy sand in texture with 7.46 pH, low in organic carbon (0.21 %), low in available nitrogen (156 kg ha^{-1}), medium in available P_2O_5 (45 kg ha^{-1}) and available K_2O (199.5 kg ha^{-1}). The soil was free from any kind of salinity /sodicity hazard. The experiment was laid out in randomized block design with eight treatments viz., T_1: Control, T_2: Integrated nutrient management (RDF + *Rhizobium* + PSB)- INM, T_3: Integrated weed management (Pendimethalin @ 1 kg a.i / ha + one HW at 30 DAS) –IWM, T_4: Integrated pest management (seed treated with fungicide + diseases and insect pest management as and when required)- IPM, T_5: INM + IWM, T_6: INM + IPM, T_7: IWM +I PM and T_8: INM + IWM + IPM with three réplications. Rajmash variety

Gujarat Rajma 1 (GR 1) was sown at second fortnight of November. The seeds were placed at 3-5 cm depth by manually in furrow keeping row to row spacing of 30 cm and plant to plant distance of 10 cm. Pre emergence herbicide Pendimethalin were measured by measuring cylinder as per the required quantity at the time of preparation of solution and applied at next day after sowing (DAS) with knapsack sprayer fitted with flat-fan nozzle using 500 liter water/ha. Recommended dose of fertilizers (100-50-00 kg N- P_2O_5 -K_20/ha) was applied in the form of diammonium phosphate and urea at the time of sowing. rajmash seed was treated with carrier based *Rhizobium* and PSB, each at the rate of 250 g per 8 kg seed and mixed well to ensure the inoculums to stick on to the surface of the seeds. Total dry weight of weeds was taken using quadrate of 0.25 m^2 size at 30 DAS. Weed data were subjected to square root transformation ($\sqrt{x+0.5}$) for uniformity before statistical analysis. Seed yield and economics recorded through standard practices.

RESULTS AND DISCUSSION

Effect on weeds:

The data on weed dry weight at 30 days after sowing (Table 2) indicated that integrated weed management practice alone or in combination of other management practices resulted in considerable reduction in total weed dry weight. The lower weed dry weight was recorded by pre emergence application of Pendimethalin @ 1 kg /ha *fb* one hand weeding at 30 days after sowing (integrated weed management) with application of pest management practices in the year of 2013-14 and 2015-16 and remained at par with treatment T_8 in both years and with treatment T_5 and T_7 in year 2015-16, while in the year 2014-15 and in the pooled result recorded lower total weed dry weight in the combination of integrated weed management, nutrient management and pest management and remained at par with the treatment T_5 and T_7. This might be due to effective control of weeds in the initial growth stages of the crop; it led to check the weeds effectively and reduced crop-weed competition in the initial stage and removal of the late emerged weeds by interculturing at 30 days after sowing. Results conformity also been recorded by (Brijbhooshan *et al*. 2017) and Panotra *et al*, 2012.

Effect on growth and yield attributes:

Growth attributes of rajmash were significantly affected by different management practices during all the years (Table 2). The higher plant height (20.69 cm) and number of branches per plant (3.15) were recorded by application of recommended dose of fertilizer (100 kg N-40 kg P_2O_5 ha^{-1}) + *Rhizobium* + PSB and Pendimethalin @ 1 kg a.i./ha + one hand weeding at 30 DAS (INM + IWM) and remained statistically at par with the treatment T_2

and T_8 while higher number of seeds per pod (3.27) and pod length (9.22cm) was recorded by combined application of INM + IWM which was remained at par with the treatment T_8, T_2, T_3 and T_8 & T_6. Significantly the highest number of pods per plant (7.93) and 100 seed weight (39.11 gm) was recorded under the treatment T_8 i.e., combination of nutrient, weed and pest management. Integrated use of nutrient, weed and pest management practices resulted in better growth of plants associated with increased availability of nutrients might have resulted in better development of growth and yield attributes under these treatments. The favorable effect of integration of crop management practices on yield attributes were also reported by pal *et al* (2016) and (Tyagi and Upadhyay, 2015).

Effect on seed yield and straw yield:

The results clearly indicate that (Table 1) treatment T_5 *i.e*., integration of nutrient and weed management practices recorded significantly higher seed yield in the all three year 2013-14, 2014-15, 2015-16 and pooled (1468 kg/ha, 1490 kg/ha, 1395 kg/ha and 1451 kg/ha, respectively). In the year 2015-16 and pooled results treatment T_5 remained statistically at par with treatment T_8 *i.e*., integration of nutrient, weed and pest management practices which was recorded seed yield 1370 and 1320 kg/ha, respectively. Same trend was observed for straw yield of rajmash, higher straw yield (2222 kg/ha) was recorded in integration of nutrient and weed management practices (T_5) and remained at par with the T_8 i.e., integration of nutrient, weed and pest management practices (2209 kg/ha) and T_2 i.e., integrated nutrient management (1880 kg/ha). benefits accruing from the integration of nutrient, weed and pest management practices might be attributed to better supply of nutrients along with conducive physical environment leading to better root activity and higher nutrient absorption, which resulted into better plant growth and superior yield attributes responsible for higher yield (Ghosh *et al.* 2006). The favorable effect of integration of inorganic fertilizers and *Rhizobium* on yield attributes and yield also reported by (kaur *et al.,* 2016) and (saxena and Verma 1995). Panotra *et al*., 2012 reported that maximum yield was recorded in fluchloralin 1.00 kg/ha and pendimethalin 1.00 kg/ha treatments with a corresponding value of 1.11. Straw yield finding shows conformity with Kumar *et al.* (2009), Kumar and Singh (2014).

Economics:

The data (Table 1) indicate that the maximum net returns (Rs. 48617) and BC ratio (1.71) was realized with treatment T_5 i.e., integration of nutrient and weed management practices. The higher seed and straw yields with these treatments may be the reason for the resultant net profit.

The results lead to a conclusion that the application of basal dose of 100 kg N + 40 kg P_2O_5 /ha and inoculate seed with *Rhizobium* + PSB (250 g each/8 kg seed) and pre emergence application of Pendimethalin @ 1 kg/ha followed by one hand weeding at 30 days after sowing may be suggested for higher economic returns and yield along with overall betterment of Rajmash crop.

References

[1] Abrol D.P.; Ramamurthy V.V. and Shrivastava K. (2006). Bean Gall Weevil and Blister Beetle as New Pests on Red Kidney Bean (Phaseolus vulgaris L.) in India. *Journal of Asia-Pacific Entomology***. 9**(4): 1-4.

[2] Brijbhooshan, Singh, V.K. and Shalini. (2017). Response of 2441ieldpea (*Pisum sativum* L. var *arvense*) to various planting methods, irrigation schedule and weed management practices. *Legume Research*. **40**(1):132-137.

[3] Ghosh P.K.; Mohanty M.; Bandyopadhyay K.K.; Painuli D.K. and Misra A.K. (2006). Effect of nutrient management Growth, competition, yields advantage and economics in soybean / pigeonpea intercropping system in semi-arid tropics of India. *Field Crops Research.* **96:** 90–97.

[4] Kaur M.; Thakur N.P.; Kumar P. and Charak A.S. (2016). Productivity and profitability of maize (*Zea mays*) as influenced by intercropping of rajmash (*Phaseolus vulgaris*) and nutrient management. Techniques under sub-alpine conditions of Jammu, India. *Legume Research*. **39** (6): 970-975

[5] Kumar B. and Singh G.R. (2014). Response of French bean (Phaseolus vulgaris L.) to various sowing methods, irrigation levels and nutrient substitution in relation to its growth, seed yield and nutrient uptake. *Journal of food legume*. **27**: 108-111.

[6] Kumar R.P.; Singh O.N.; Singh Y.; Dwivedi S. and Singh J.P. (2009). Effect of integrated nutrient management on growth, yield, nutrient uptake and economics of French bean (*Phaseolus vulgaris*). *Indian Journal of Agricultural Sciences.***79**(2): 122-128.

[7] Longkumar T.E. and Singh P. K., (2016). Effect of integrated nutrient management on major nutrient of soil in rajmash in acid soil of Nagaland. *An Asian Journal of Soil Science.* **11**(1): 82-85.

[8] Mukherjee D. (2016). Studies on integrated nutrient management on growth and productivity of Indian mustard (*Brassica juncea*) in high altitude range of Himalaya. *Journal of Oilseeds Research*. **33**: 33-37.

[9] Panotra N.; Singh O.P. and Kumar A. (2012). Effect of chemical and mechanical weed management on yield of French bean–sorghum cropping system. *Indian Journal of Weed Science* **44**(3): 163–166.

[10] Pal A.K., Singh, R.S., Shukla, U.N. and Singh S. (2016). Growth and production potential of pigeonpea (*Cajanus cajan* L.) as influenced by intercropping and integrated nutrient management. *Journal of Applied and Natural Science*, **8**(1):179-183.

[11] Singh et al., 2014. Effect of agronomic practices on growth, dry matter and yield of Rajmash (*Phaseolus Vulgaris* L.). *African Journal of Agricultural Research.* **9**(51): 3711-3719.

[12] Tyagi P.K. and Upadhay A.K. (2015). Effect of integrated nutrient management on yield, quality, nutrients uptake and economics of summer greengram. *Annals of Plant and Soil Research*. **17**(3): 242-247.

Table 1: Effect of different crop management treatments on seed and straw yield of rajmash

Treatment	Seed Yield (kg/ha)				Straw Yield (kg/ha)				Net returns	B:C Ratio
	2013-14	2014-15	2015-16	Pooled	2013-14	2014-15	2015-16	Pooled		
T_1	771	459	453	561	831	972	956	920	8933	0.43
T_2	1149	1263	1000	1138	1262	2183	2193	1880	35786	1.44
T_3	853	643	748	748	879	1363	1651	1298	15533	0.63
T_4	762	520	499	593	824	1187	1015	1009	8940	0.39
T_5	1468	1490	1395	1451	1259	2368	3040	2222	48617	1.71
T_6	1184	1042	895	1040	1057	1685	1937	1559	28476	1.07
T_7	899	503	664	689	905	1040	1382	1109	10380	0.40
T_8	1301	1289	1370	1320	1371	2261	2995	2209	40258	1.33
S.Em.+	51.15	44.05	66.89	61.55	61.47	78.29	149.9	183.60	-	-
C.D. at 5%	155.1	133.6	202.9	186.69	186.4	237.5	454.8	556.89	-	-
C.V. %	8.45	8.47	13.20	10.08	10.15	8.31	13.70	11.80	-	-
Y	-	-	-	Sig	-	-	-	Sig	-	-
Y x T	-	-	-	Sig	-	-	-	Sig	-	-

T_1: Control, **T_2:** Integrated nutrient management (RDF + *Rhizobium* + PSB)- INM, **T_3:** Integrated weed management (Pendimethalin @ 1 kg / ha + one HW at 30 DAS) -IWM, **T_4:** Integrated pest management (seed treated with fungicide + diseases and insect pest management as and when required)- IPM, **T_5:** INM + IWM, **T_6:** INM + IPM, **T_7:** IWM +I PM, **T_8:** INM + IWM + IPM.

Table: 2 Effect of different crop management practices on weed dry weight, growth and yield attributes in rajmash (Pooled data of three years)

Treatment	Weed dry wt. at 30 DAS (g/m^2)				Plant height (cm)	No. of branches/ plant	No. of pods/ plant	Pod length (cm)	No. of seeds/ pod	100 Seed wt. (g)
	2013-14	2014-15	2015-16	Pooled						
T_1	4.99 (24.43)	4.80 (22.80)	5.95 (35.08)	5.25 (27.44)	14.47	1.04	3.55	7.64	2.38	35.43
T_2	4.34 (18.40)	2.99 (8.56)	5.15 (26.37)	4.16 (17.78)	19.42	2.82	5.72	8.68	2.93	36.70
T_3	1.43 (1.87)	2.93 (8.16)	1.03 (0.58)	1.79 (3.54)	15.35	1.31	5.70	8.55	2.64	37.01
T_4	4.90 (23.52)	4.52 (20.16)	5.14 (25.93)	4.85 (23.20)	15.21	1.09	3.40	8.45	2.82	35.84
T_5	2.75 (7.15)	1.83 (2.88)	1.27 (1.17)	1.95 (3.73)	20.69	3.15	7.67	9.22	3.27	38.12
T_6	3.89 (14.93)	4.56 (20.56)	5.76 (33.33)	4.74 (22.94)	18.04	1.93	7.07	8.42	3.00	38.13
T_7	2.89 (7.89)	2.03 (3.68)	1.31 (1.25)	2.07 (4.27)	16.27	2.18	5.27	8.20	2.60	36.15
T_8	1.73 (2.67)	1.86 (2.96)	1.29 (1.23)	1.63 (2.29)	19.78	3.07	7.93	8.99	3.07	39.11
SEm ±	0.24	0.25	0.27	0.48	0.59	0.21	1.37	0.25	0.09	1.07
C. D. (0.05 %)	0.7	0.8	0.8	1.44	1.80	0.64	4.16	0.75	0.27	3.24
C. V. (%)	12.31	13.65	13.72	13.23	8.99	14.41	11.83	8.23	11.63	3.29
Y	-	-	-	NS	Sig	Sig	Sig	Sig	NS	Sig
Y x T	-	-	-	Sig	NS	Sig	Sig	NS	NS	Sig

T_1: Control, **T_2:** Integrated nutrient management (RDF + *Rhizobium* + PSB)- INM, **T_3:** Integrated weed management (Pendimethalin @ 1 kg / ha + one HW at 30 DAS) -IWM, **T_4:** Integrated pest management (seed treated with fungicide + diseases and insect pest management as and when required)- IPM, **T_5:** INM + IWM, **T_6:** INM + IPM, **T_7:** IWM +I PM, **T_8:** INM + IWM + IPM

*Figures in the parenthesis are original values. All Figures are square root ($\sqrt{x + 0.5}$) transformed values