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Study on Yield, Nutrient Content and Nutrient Uptake of Rice-Based Intercropping System as Influenced by Integrated Nutrient Management

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ABSTRACT: A field experiment was conducted during *kharif* season of 2019 and 2020 in the experimental farm, Department of Agronomy, School of Agricultural Sciences, Nagaland University, Medziphema campus, to study the effect of intercropping of groundnut and soybean with upland rice under different nutrient management practices in the rainfed condition of Nagaland. The experiment was conducted in a randomized block design with three replications. The treatment consisted of five cropping systems C_1: Sole rice, C_2: Sole groundnut, C_3: Sole soybean, C_4: Rice + groundnut (3:1), C_5: Rice + soybean (3:1) and three nutrient management practices., N_1: 100% RDF + FYM @ 2.5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed, N_2: 75% RDF + FYM @ 5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed, N_3: 50% RDF + FYM @ 7.5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed. Among the different intercropping system, rice + soybean (3:1) recorded the highest nitrogen, phosphorous and potassium (NPK) uptake, grain and straw yield. Among different nutrient management practices, application of 75% RDF + FYM @ 5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed recorded significantly higher nitrogen, potassium (NPK) content and uptake, grain and straw yield. The results of this experiment indicate that rice intercropped with soybean and application of 75% RDF + FYM @ 5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} is superior to other treatments and can be used in similar climatic conditions.

Keywords: Cropping system, Nutrient, Uptake, FYM, RDF.

INTRODUCTION

In India, rice-based farming systems account for over 10.5 million acres area among 30 major cropping systems identified in India (Sharma, 2009). Rice is the staple meal for more than a half of world's population and approximately 70% of Indians (Tripathy *et al.*, 2017). It has enormously assisted the socio-economic development of the rural people in India. Farmers acquire most of their food security from this cropping system. But the key to raising agricultural output is fertilizers. However, in the case of intensive cultivation, growing exhausting crops, use of unbalanced and inadequate fertilizers along with restricted use of organic manures and bio fertilizers have made the soils not only deficient in nutrients, but also deteriorated in its health as a result of which the crop response to the recommended dose of N-fertilizer has decreased. In such circumstances, integrated nutrient management (INM) has taken on a significant role and is essential for maintaining soil production. Integrated Nutrient Management (INM) is a theory that takes into account the nutrient cycle including soils, crops, and animals, nutrient deficits, organic recycling, concurrent use of organic manures and mineral fertilizers, and biological nitrogen fixing capacity. Optimal crop yields and long-term soil productivity may be maintained with the combined application of organic manures and inorganic fertilizers (Puli *et al.*, 2016). In addition to providing macronutrients and meeting the need for micronutrients, organic manures, especially farmyard manure (FYM), can improve soil health. Keeping the aforementioned facts in mind, the current inquiry was conducted to study on yield, nutrient content and nutrient uptake of rice-based intercropping system as influenced by integrated nutrient management.

MATERIAL AND METHODS

A field experiment was carried out during *kharif* seasons of 2019 and 2020 at the Experimental Research Farm of School of Agricultural Sciences (SAS), Nagaland University, Medziphema Campus. The site was well drained sandy loam, low in available N and P, medium in available K during 2019 and 2020 respectively. The location of the experimental site was situated at 25°45′43″N latitude and 95°53′04″N longitude at an elevation of 310 m above mean sea level. The experiment was conducted using three replications in a randomized block design. The treatment consisted of five cropping system *viz*., C_1: Sole rice, C_2: Sole groundnut, C_3: Sole soybean, C_4: Rice + groundnut (3:1), C_5: Rice + soybean (3:1) and three nutrient management practices *viz*., N_1: 100% RDF + FYM @ 2.5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed, N_2: 75% RDF + FYM @ 5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed, N_3: 50% RDF + FYM @ 7.5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed. The net plot size of 4m × 3m and a spacing of rice was done at 20 cm row to row and 10 cm plant to plant. In case of groundnut and soybean, planting was done by dibbling in furrows at the spacing of 40 cm row to row and 15 cm plant to plant for groundnut crop and 10 cm plant to plant for soybean crop. The groundnut and soybean as intercrop, were sown at row to row spacing of 20 cm for both the crops and plant to plant spacing of 15 cm for groundnut 10 cm for soybean intercrops in 3:1 method of planting. Both the base crop and components crops were sown on last week of June in all these years. The amount of FYM was calculated for each plot separately and applied three weeks before sowing of rice, groundnut and soybean as per treatment as mentioned earlier. Urea (46% N), SSP (16% P_2O_5), and MOP (60% K_2O) were used to meet the crops fertilizer needs. Intercrop and sole crop of rice received different levels of fertilizer i.e. for 100% NPK-60 kg ha^{-1} + 30 kg ha^{-1} P_2O_5 + 20 kg ha^{-1} P_2O_5, for 75% NPK- 45 kg ha^{-1} N + 22.5 kg ha^{-1} P_2O_5 + 15 kg ha^{-1} K_2O and for 50% NPK- 30 kg ha^{-1} N + 15 kg ha^{-1} P_2O_5 + 10 kg ha^{-1} K_2O. The total quantity of P and K and one-third (⅓) of nitrogen at the time of sowing was applied and the remaining two-thirds (⅔) of N in two equal doses at tillering and panicle initiation stage was applied as per treatment as mentioned earlier. No additional dose of fertilizer was given to groundnut and soybean in intercropping with rice. Sole crop of groundnut received different levels of fertilizer i.e. for 100% NPK-20 kg ha^{-1} N + 40 kg ha^{-1} P_2O_5 + 30 kg ha^{-1} K_2O, for 75% NPK- 15 kg ha^{-1} N + 30 kg ha^{-1} P_2O_5 + 22.5 kg ha^{-1} K_2O and for 50% NPK- 10 kg ha^{-1} N + 20 kg ha^{-1} P_2O_5 + 15 kg ha^{-1} K_2O. Sole crop of soybean received different levels of fertilizer i.e. for 100% NPK-20 kg ha^{-1} N + 60 kg ha^{-1} P_2O_5 + 40 kg ha^{-1} K_2O, for 75% NPK- 15 kg ha^{-1} N + 45 kg ha^{-1} P_2O_5 + 30 kg ha^{-1} K_2O and for 50% NPK- 10 kg ha^{-1} N + 30 kg ha^{-1} P_2O_5 + 20 kg ha^{-1} K_2O. In the case of sole groundnut and soybean full dose of nitrogen, phosphorous and potassium were applied as basal doses at the time of sowing. The variety used in the study were: 'Sahbhagi Dhan' rice, 'ICGS 76' groundnut and 'JS 9752' soybean. The remaining agronomic practices were followed as per recommended packages of practices.

For chemical assessment, randomly chosen plant samples were collected treatment-wise. Straw and grains were separated, air-dried and finally oven dried at 65°C and grounded in a grinding machine to pass through a 30 mesh sieve. Grain and straw samples were analyzed for nitrogen by modified Kjeldahl's method (Jackson, 1973), phosphorus by di-acid digestion and yellow colour development method (Jackson, 1973) and potassium by flame photometric method (Jackson, 1973). The uptake was further calculated by using the formula Nutrient uptake (kg ha^{-1})

$$\text{Nutrient uptake (kg ha}^{-1}\text{)} = \frac{\text{Per cent nutrient content in grain or straw} \times \text{grain or straw yield (kg ha}^{-1}\text{)}}{100}$$

The harvested crop was sun-dried, threshed and winnowed properly. The grains/ seeds were packed separately for each plot and marked. The weight of the grains/seeds was recorded and converted to t ha^{-1}. The straw/stover was sun-dried properly for a few days to reduce the moisture and weight was taken separately for each plot, recorded and converted to t ha^{-1}.

RESULTS AND DISCUSSION

A. Nitrogen, Phosphorous and Potassium content of rice

The pooled data of both the years on nitrogen, phosphorous and potassium content in grain and straw of rice revealed that there was no significant effect due to the cropping system (Table 1).

Close examination of the pooled data revealed that application of 75% RDF along with FYM @ 5 t ha^{-1} and biofertilizer consortium @ 20 g kg^{-1} seed resulted in significantly highest N P K content in seed and straw. However, the application of 50% RDF along with FYM @ 7.5 t ha^{-1} and biofertilizer consortium @ 20 g kg^{-1} seed registered significantly lowest nitrogen, phosphorous and potassium content in grain and straw (Table 1). Similar finding was also reported by Garai *et al*. (2014); Sai Ram *et al*. (2020). This might be due to the combined effect of organic and inorganic fertilizers that significantly influenced the concentration of nitrogen, phosphorous and potassium content in grain and straw. Similar results were also reported by Kour *et al.* (2013).

B. Uptake and yield of rice

The variations on N P K uptake due to the cropping system were found to be significant. The highest N, P and K uptake in grain and N and K uptake in straw were recorded in treatment sole rice, which was found statistically at par with rice intercropped with soybean. The lowest was recorded in rice intercropped with groundnut (Table 2). This could be mainly due to the significantly higher uptake of nutrient by grains and straw because of their higher grain and straw yield as a consequence of increased total dry matter in rice. Uptake of any nutrient by crop is directly proportional to dry matter production, grain and straw yield, the increased grain and straw yield, have led to higher uptake of these nutrients under sole crop of rice. There was no significant effect due to cropping system in P uptake in straw. Similar result was reported by Oskoii *et al*. (2015) when maize intercropped with faba bean.

The analysis of variance study of the data indicated towards a significant difference among the responses of the various nutrient management practices.

Significantly the highest value of N, P and K uptake in grain and straw was recorded in N_2 (75% RDF along with FYM @ 5 t ha^{-1} and biofertilizer consortium @ 20 g kg^{-1} seed) treatment, while the lowest was recorded in 50% RDF along with FYM @ 7.5 t ha^{-1} and biofertilizer consortium @ 20 g kg^{-1} seed treatment (Table 2). Banik and Sharma (2008) reported that nutrient uptake in rice under the integrated nutrient management system was greater due to greater biomass production and nutrient mineralization from organic sources. An increase in fertilizer levels significantly increased the N P K uptake in rice (Choudhary and Suri 2009). A similar finding was also reported by Sujathamma and Reddy (2004).

The highest grain and straw yield were recorded in sole rice treatment which was at par with rice intercropped with soybean (Table 2). The highest grain yield of rice was obtained in sole cropping of rice in all the intercropping system. These results confirm the findings Mandal *et al*. (1997) who obtained more yield of rice in sole cropping than inclusion of intercrop. Among intercropping system highest grain yield was recorded in rice + soybean (3:1) intercropping system.

The effect of nutrient management on grain and straw yield showed a significant increase in yield. It was observed that the application of 75% RDF along with FYM @ 5 t ha^{-1} and biofertilizer consortium @ 20 g kg^{-1} seed significantly increased the yield. The minimum value was recorded at application of 50% RDF + FYM @ 7.5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed (Table 2). The highest grain yield in FYM and fertilizer treatment plot might be due to higher value of yield attributing character *viz* number of panicles m^{-2} and panicle length. Sravan and Singh (2019) also found similar result that rice grain yield was increased by applying the suggested nutrients in an integrated approach (75% RDF + 25% FYM).

C. Nitrogen, Phosphorous and Potassium content, uptake and yield of groundnut

From the pooled data of both the years on nitrogen, phosphorous and potassium content in seed and stover of groundnut revealed that there is no significant effect due to the cropping system (Table 3).

Nutrient management practices significantly influenced the nitrogen, phosphorous and potassium content in seed and stover; the highest nitrogen, phosphorous and potassium content were recorded in N_2 treatment (75% RDF along with FYM @ 5 t ha^{-1} and biofertilizer consortium @ 20 g kg^{-1} seed). The significantly lowest N P K uptake was noted in treatment N_3 (50% RDF along with FYM @ 7.5 t ha^{-1} and biofertilizer consortium @ 20 g kg^{-1} seed) (Table 3). Similar findings were also observed by Tatpurkar *et al*. (2014); Vallabh and Brigendra (2015).

From the two years of pooled data it was revealed that there was a significant effect on N P and K uptake in seed and stover, seed yield and stover yield due to cropping system. Significantly highest N, P and K uptake in seed and stover, seed yield and stover yield was recorded in sole groundnut and the lowest was recorded in rice intercropped with groundnut (Table 4). A similar result was reported by Gao *et al*. (2019), who reported that sole maize and sole groundnut had greater N, P and K uptake than intercropped maize and groundnut, respectively. Higher N, P and K uptake in seed and stover due to higher growth attributes, seed yield and stover yield. This result corroborates with the findings of Razzaque *et al*. (2007) who reported that less groundnut yield was obtained from the intercropping system than sole crop due to the shading effect of chilli on groundnut.

The pooled data of both years also revealed a significant difference with the highest N, P and K in seed and stover, seed yield and stover yield when the crop was applied with 75% RDF + FYM @ 5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed. The lowest N, P and K uptake in seed and stover, seed yield and stover yieldwas recorded when the crop was applied with 50 % RDF+ FYM @ 7.5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed (Table 4). This may be because the use of both chemical fertilizers and a sufficient quantity of FYM has always encouraged the absorption of nutrients owing to enhanced root development brought on by a congenial soil environment. The results of the present investigations were in close agreement with the findings of Zalate and Padmini (2010); Tatpurkar *et al*. (2014); Vallabh and Brigendra (2015).

D. Nitrogen, Phosphorous and Potassium content, uptake and yield of soybean

The pooled data of both the years on N, P and K content in seed and stover of soybean revealed no significant effect due to the cropping system (Table 5).

Nutrient management practices significantly influenced the N, P and K content in seed and stover, the highest N P K content were recorded at N_2 treatment (75% RDF along with FYM @ 5 t ha^{-1} and biofertilizer consortium @ 20 g kg^{-1} seed). The significantly lowest N, P and K uptake were recorded in treatment N_3 (50% RDF along with FYM @ 7.5 t ha^{-1} and biofertilizer consortium @ 20 g kg^{-1} seed) (Table 5). Using FYM in combination with potassium, phosphorus, and nitrogen maintained the available N, P and K in soil sufficiently. Similar findings were reported by Jagtap (2001); Tumbare (2002).

Pooled data revealed a significant effect on N, P and K uptake in seed and stover, seed yield and stover yield due to cropping systems. Significantly the highest N, P and K uptake in seed and stover, seed yield and stover yield was recorded in sole soybean and the lowest in rice intercropped with soybean (Table 6). This may be due to the significantly higher uptake of nutrient by seed and stover because of their higher seed and stover yield due to increased total dry matter in sole soybean. Singh *et al*. (2008) reported that sole soybean removed significantly higher amounts of N, P and K which might be attributed to the cumulative effect of the highest biomass production under this treatment.

The pooled data of both years also revealed a significant difference with the highest N, P and K uptake in seed and stover seed yield and stover yield when the crop was applied with 75% RDF+ FYM @ 5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed. The lowest N P K uptake in seed and stover, seed yield and stover yield were recorded when the crop was applied with 50% RDF + FYM @ 7.5 t ha^{-1} + biofertilizer consortium @ 20 g kg^{-1} seed (Table 6). With the addition of FYM, the availability of nitrogen, phosphorus, and potassium increased. As a result, NPK uptake overall increased. As a result total uptake of NPK increased. Similar results were supported by Bandopadhyay *et al*. (2016); Singh *et al*. (2020).

Table 1: Effect of cropping systems and nutrient management practices on N, P and K content of rice (pooled data over 2 years).

Treatments	N content (%) in grain	N content (%) in straw	P content (%) in grain	P content (%) in straw	K content (%) in grain	K content (%) in straw
Cropping system (C)						
C_1	1.236	0.308	0.232	0.147	0.301	1.160
C_4	1.222	0.296	0.223	0.145	0.295	1.150
C_5	1.228	0.303	0.226	0.147	0.297	1.155
SEm±	0.011	0.003	0.004	0.003	0.005	0.009
CD (P=0.05)	NS	NS	NS	NS	NS	NS
Nutrient management (N)						
N_1	1.223	0.300	0.221	0.143	0.292	1.150
N_2	1.271	0.365	0.240	0.157	0.316	1.211
N_3	1.193	0.242	0.220	0.138	0.285	1.104
SEm ±	0.011	0.003	0.004	0.003	0.005	0.009
CD (P=0.05)	0.031	0.010	0.010	0.008	0.014	0.025
Interaction (C × N)	NS	NS	NS	NS	NS	NS

Table 2: Effect of cropping systems and nutrient management practices on N P K uptake and yield of rice (pooled data over 2 years).

Treatments	N uptake (kg ha^{-1}) in grain	N uptake (kg ha^{-1}) in straw	P uptake (kg ha^{-1}) in grain	P uptake (kg ha^{-1}) in straw	K uptake (kg ha^{-1}) in grain	K uptake (kg ha^{-1}) in straw	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
Cropping system (C)								
C_1	38.09	15.68	7.15	7.43	9.26	58.72	3.08	5.05
C_4	32.33	13.62	5.89	6.60	7.80	52.19	2.64	4.52
C_5	36.62	14.79	6.75	7.17	8.87	56.34	2.98	4.87
SEm±	0.49	0.22	0.15	0.20	0.13	1.01	0.04	0.08
CD (P=0.05)	1.42	0.64	0.44	NS	0.38	2.92	0.11	0.24
Nutrient management (N)								
N_1	35.94	14.47	6.50	6.92	8.57	55.39	2.94	4.82
N_2	40.03	18.78	7.57	8.11	9.93	62.46	3.15	5.16
N_3	31.07	10.84	5.72	6.18	7.42	49.40	2.60	4.47
SEm±	0.49	0.22	0.15	0.20	0.13	1.01	0.04	0.08
CD (P=0.05)	1.42	0.64	0.44	0.58	0.38	2.92	0.11	0.24
Interaction (C × N)	S	NS	NS	NS	S	NS	S	NS

Table 3: Effect of cropping systems and nutrient management practices on N P K content of groundnut (pooled data over 2 years).

Treatments	N content (%) in seed	N content (%) in stover	P content (%) in seed	P content (%) in stover	K content (%) in seed	K content (%) in stover
Cropping system (C)						
C_2	3.097	1.413	0.343	0.250	1.404	2.133
C_4	3.052	1.406	0.339	0.245	1.397	2.114
SEm±	0.034	0.013	0.003	0.003	0.014	0.014
CD (P=0.05)	NS	NS	NS	NS	NS	NS
Nutrient management (N)						
N_1	3.082	1.399	0.336	0.243	1.404	2.124
N_2	3.401	1.496	0.356	0.261	1.535	2.204
N_3	2.741	1.333	0.331	0.238	1.264	2.042
SEm±	0.041	0.016	0.003	0.003	0.018	0.017
CD (P=0.05)	0.122	0.048	0.009	0.009	0.052	0.050
Interaction (C × N)	NS	NS	NS	NS	NS	NS

Table 4: Effect of cropping systems and nutrient management practices on N P K uptake and yield of groundnut (pooled data over 2 years).

Treatments	N uptake (kg ha^{-1}) in seed	N uptake (kg ha^{-1}) in stover	P uptake (kg ha^{-1}) in seed	P uptake (kg ha^{-1}) in stover	K uptake (kg ha^{-1}) in seed	K uptake (kg ha^{-1}) in stover	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})
Cropping system (C)								
C_2	39.27	40.54	4.32	7.15	17.77	61.07	1.26	3.36
C_4	18.03	19.71	1.99	3.43	8.24	29.60	0.59	1.67
SEm±	0.62	0.79	0.05	0.09	0.20	1.02	0.02	0.04
CD (P=0.05)	1.82	2.32	0.16	0.26	0.60	2.99	0.04	0.12
Nutrient management (N)								
N_1	27.84	29.49	3.03	5.12	12.65	44.85	0.90	2.50
N_2	35.64	35.43	3.73	6.20	16.05	52.19	1.05	2.73
N_3	22.47	25.45	2.71	4.56	10.32	38.97	0.82	2.31
SEm±	0.76	0.96	0.07	0.11	0.25	1.24	0.02	0.05
CD (P=0.05)	2.23	2.84	0.19	0.32	0.74	3.67	0.05	0.15
Interaction (C × N)	S	NS	S	S	S	NS	NS	NS

Table 5: Effect of cropping systems and nutrient management practices on N P K content of soybean (pooled data over 2 years).

Treatments	N content (%) in seed	N content (%) in stover	P content (%) in seed	P content (%) in stover	K content (%) in seed	K content (%) in stover
Cropping system (C)						
C_3	6.098	1.902	0.383	0.280	1.603	2.466
C_5	6.061	1.873	0.379	0.275	1.594	2.456
SEm±	0.020	0.026	0.002	0.002	0.014	0.022
CD (P=0.05)	NS	NS	NS	NS	NS	NS
Nutrient management (N)						
N_1	6.054	1.886	0.383	0.279	1.592	2.509
N_2	6.168	1.999	0.397	0.293	1.748	2.645
N_3	6.017	1.779	0.363	0.260	1.456	2.228
SEm±	0.025	0.032	0.002	0.002	0.018	0.027
CD (P=0.05)	0.073	0.095	0.007	0.007	0.052	0.079
Interaction (C × N)	NS	NS	NS	NS	NS	NS

Table 6: Effect of cropping systems and nutrient management practices on N P K uptake and yield of soybean (pooled data over 2 years).

Treatments	N uptake (kg ha^{-1}) in seed	N uptake (kg ha^{-1}) in stover	P uptake (kg ha^{-1}) in seed	P uptake (kg ha^{-1}) in stover	K uptake (kg ha^{-1}) in seed	K uptake (kg ha^{-1}) in stover	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})
Cropping system (C)								
C_3	107.82	69.08	6.80	10.17	28.57	89.86	1.77	3.61
C_5	50.24	33.26	3.16	4.88	13.34	43.70	0.83	1.77
SEm±	1.32	1.75	0.10	0.24	0.32	2.48	0.02	0.08
CD (P=0.05)	3.90	5.16	0.28	0.71	0.94	7.31	0.07	0.22
Nutrient management (N)								
N_1	76.51	48.72	4.84	7.22	20.11	64.80	1.26	2.58
N_2	94.61	62.31	6.10	9.17	26.80	82.46	1.53	3.11
N_3	65.98	42.48	3.99	6.18	15.97	53.09	1.10	2.38
SEm±	1.62	2.14	0.12	0.29	0.39	3.04	0.03	0.09
CD (P=0.05)	4.78	6.32	0.35	0.86	1.15	8.96	0.09	0.27
Interaction (C × N)	S	NS	S	NS	S	NS	NS	NS

CONCLUSIONS

The present investigation revealed that among intercropping systems, rice + soybean intercropping system was found to be most suitable than rice+ groundnut intercropping. This system recorded the highest grain yield. Among the different doses of nutrient management applied, N_2-75% RDF along with FYM @ 5 t ha^{-1}and biofertilizer consortium @ 20 g kg^{-1}

seed was found to be most suitable as it registered the highest production under the rainfed condition of Nagaland.

FUTURE SCOPE

It is suggested that the experiment may be repeated at different sites for at least one or two years with more specific treatment combinations to get clear-cut recommendations for farmers.

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REFERENCES

Bandopadhyay, K. K., Mishra, A. K., Gosh, P. K. and Hati, K. M. (2016). Effect of integrated use of FYM and chemical fertilizers on soil health properties and productivity of soybean. *Soil Tillage Research*, *110*, 115−125.

Banik, P. and Sharma, R. C. (2008). Effects of integrated nutrient management with mulching on rice-based system in rainfed eastern plateau area. *Indian Journal of Agricultural Sciences*, *78*, 240–243.

Choudhary, A. K. and Suri, V. K. (2009). Effect of organic manures and inorganic fertilizers on productivity, nutrient uptake, and soil fertility in wheat (*Triticum aestivum*)–paddy (*Oryza sativa*) crop sequence in Western Himalayas. *Current Advances in Agricultural Sciences*, *1*(2), 65–69.

Gao, H., Meng, W., Zhang, C., Werf, W., Zhang, Z., Wan, S. and Zhang, F. (2019). Yield and nitrogen uptake of sole and intercropped maize and peanut in response to N fertilizer input. Food and Energy Security.https:// doi.org/ 10.1002/fes3.187.

Garai, T. K., Datta, J. K. and Mondal, N. K. (2014). Evaluation of integrated nutrient management on boro rice in alluvial soil and its impacts upon growth, yield attributes, yield and soil nutrient status. *Archives of Agronomy and Soil Science*, *60*(1), 1-14.

Jackson, M. L. (1973). Soil chemical analysis. Prentice Hall of Indian Pvt. Ltd., New Delhi. Pp 183-192.

Jagtap, P. S. (2001). Studies on the integrated nutrient supply system for the soybean (*Glycine max* L.) crop. M.Sc. (Agri.) Thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri.

Kour, R., Sharma, B.C., Kumar, A. and Kour, P. (2013). Nutrient uptake by chickpea + mustard intercropping system as influenced by weed management. *Indian Journal of Weed Science*, *45*(3), 183–188.

Mandal, B. K., Tapan, K. Jana and Sanjay, S. (1997). Yield and monetary advantage of intercropping rice in Nadia region of West Bengal. *Indian journal of Agronomy*, *42* (2), 196-200.

Oskoii, F. J., Nasrollahzadeh, S., Shakiba, M. R. and Nasab, A. D. M. (2015). Effect of different intercropping patterns on yield and yield components of maize (*Zea mays* L.) and faba bean (*Vicia faba* L.). *Biological Forum – An International Journal*, *7*(2), 854-858.

Puli, M.R., Prasad, P.R.K., Ravindra, P.B., Jayalakshmi, M. and Burla, S. R. (2016). Effect of organic and inorganic sources of nutrients on rice crop. *Oryza*, *53*,151-159.

Razzaque, M. A., Rafiquzzaman, S., Bazzaz, M. M., Ali, M. A. and Talukdar, M. M. R. (2007). Study on the intercropping groundnut with chilli at different plant populations. *Bangladesh Journal of Agricultural Research*, *32*(1), 37-43.

Sai Ram, M., Maitra, S., Shankar, T. and Duvvada, S. K. (2020). Effect of integrated nutrient management on growth, yield, nutrient content and economics of summer rice (*Oryza sativa* L.). *Indian Journal Pure and Applied Bioscience*, *8*(3), 421-427.

Sharma, R. (2009). Effect of long-term integrated nutrient management system on soil and crop productivity in rice wheat crop sequence Ph.D. thesis, Department of Agronomy, CSK Himachal Pradesh Krishi Vishwavidyalaya and Palampur, India.

Singh, N., Kushwaha, H. S. and Singh, A. (2020). Integrated nutrient management on growth, yield, nutrient uptake and fertility balance in soybean (*Glycine max* L.) – Wheat (*Triticum aestivum* L.) cropping sequence. *International Journal of Bio-resource and Stress Management*, *11*(4), 405-413.

Singh, U., Saad, A. A. and Singh, S. R. (2008). Production potential, biological feasibility and economics viability of maize-based intercropping system under rain fed conditions of Kashmir valley. *Indian Journal of Agricultural Sciences*, *78*(12), 1023-1027.

Sravan, U. S. and Singh, S. P. (2019). Effect of integrated nutrient management on yield and quality of basmati rice varieties. *Journal of Agricultural Science*, *11* (5), 93-103.

Sujathamma, P. and Reddy, S. D. (2004). Growth, yield and nitrogen uptake of low land rice as influenced by integrated nutrient management. *Indian Journal of Agricultural Research*, *38*, 268-272.

Tatpurkar, S. G., Pushpa, V. V. and Barange (2014). Effect of nutrient management on yield, quality, nutrient content and uptake of groundnut in shrink-swell soil. *International Journal of Agricultural Sciences*, *10* (1), 291-293.

Tripathy, S. K., Ranjan, R., Sasmita, D., Bastia, D. L. D. N., Baisakh, B. and Satpathy, P. C. (2017). Isolation of useful scented rice mutants and comparative assessment of genetic diversity. *Journal of Environmental Biology*, *37*, 65-73.

Tumbare, A.D. (2002). Integrated nutrient management system for soybean – onion cropping sequence. A. Ph.D. Thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.

Vallabh, N. C. and Brigendra, S. R. (2015). Performance evaluation of vermicompost on yield of kharif groundnut and cotton crops. *International Journal Forestry and Crop Improvement*, *6*(2), 127-131.

Zalate, P. Y. and Padmani, D. R. (2010). Effect of organic manure and biofertilizer on growth and yield attributing character of *kharif* groundnut (*Arachis hypogaea* L.). *International Journal of Agricultural Sciences*, *5*(2), 343-345.

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