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Response of Promising Ricebean [*Vignaumbellata* [(Thunb.) Ohwi & Ohashi] Genotypes in Different Levels of Nitrogen

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Abstract: ***A field experiment was conducted at the instructional farm of All India Co-Ordinate Research Network* (AICRN) *on Potential Crops under Orissa University of Agriculture and Technology, Bhubaneswar during Kharif2016 to study the response of promising ricebean [Vignaumbellata (Thunb.) Ohwi &Ohashi] genotypes to different levels of nitrogen in a sandy loam soil with pH 5.46, available nitrogen 230 kg/ha, available phosphorus 30.8 kg/ha and available potash 180.3 kg/ha..Twenty four(24) treatment combinations comprising of six(6) varieties in the main plot (RBL 1, RBL 6, RBL 35, Phulbani Local, BRB 5, BRBM102) and four(4) levels of nitrogen (0, 20, 40 and 60 kg N /ha) in the sub-plot were tested in a split plot design with three(3) replications. Highest seed yield (790.08 kg/ha) was obtained from the variety BRBM 102 followed by Phulbani Local (702.08kg/ha). Application of successive dose of nitrogen up to 40 kg/ha produced maximum seed yield of 865.06 kg/haand stover yield of 2231.61kg/ha. Seed yield increased by 20.76, 39.79 and 49.65% with application of 40 kg N/haover 20, 60 and 0 kg N/ha respectively. Variety BRBM102 recorded maximum yield attributing characters like number of clusters per plant (17.18), pods per plant (61.38) and test weight (59.35g). Irrespective of varieties, application of 40 kg N/ha favorably influenced the yield attributing characters. The highest net return of Rs.12947.00 per ha was obtained with the variety BRBM102 at 40 kg N/ha with a Benefit: Cost ratio of 1.81.***

Keywords: Economics, Nitrogenlevels, Ricebean genotypes and Yield performance.

1. Introduction

Pulses for its high protein content& nutritional potential [1] form an important constituent of human diet.It plays a key role in improving and sustaining soil productivity on account of nitrogen fixation and additions of huge amount of organic matter. India is producing 14.76 million tons of pulses from an area of 23.63 million hectare and productivity of 650 kg/ha and is the largest pulses producing countries in the world. The corresponding figures of Odisha are 1.62mha, 0.65mt and 403kg ha^{-1}respectively [2]. However, about 2-3 million tons of pulses are imported annually to meet the domestic consumption requirement. Thus, there is need to increase production and productivity of pulses in the country by more intensive interventions.

Variety plays an important role in increasing the productivity of crops. The ricebean varieties that are being presently cultivated have an advantage of good yield potential.Hence an attempt was made to evaluate the recently developed high yielding superior genotypes to exploit the higher yield potential.

2. Literature Survey

Unlike other legumes, ricebean has a high nitrogen requirement [3].It responds to 40kg N ha^{-1}[4] but the upland soils of Odisha in which ricebean is grown are sandy to loamy sand in texture, low inorganic matter, poor in fertility and pH varying from 4.5 to 6.5[5].In such poor soil nitrogen application of nitrogen facilitate optimum growth and development of the crop and increase in yield. However nitrogen doses beyond a critical limit have been found to depress the process of symbiosis particularly under limited moisture supply [6]. A higher application of fertilizer may hinder pod formation and reduce seed yield [7]. Therefore it is necessary to evaluate the recently developed varieties and to assess their response to nitrogen which is the key input in the production system. Hence the present experiment entitle "Response of promising ricebean genotypes in different levels of nitrogen" was conducted to compare the yield performance among the ricebean genotypes at different levels of nitrogen and to compute the economics of ricebean production under different levels of nitrogen.

3. Material and Methods

The experiment was conducted in the instructional farm ofAll India Co-Ordinate Research Network (**AICRN**) on Potential Crops under Orissa University of Agriculture and Technology, Bhubaneswar during the ***Kharif***2016 to study the response of ricebean genotype in different levels of nitrogen .The field experiment was laid out in a split-plot design with three replications. There were altogether 24 treatment combinations with main-plot[Variety]: RBL1, RBL6, RBL35 Phulbani Local, BRB5, BRBM102] and sub-plot [Fertilizer N Kg/ha]: Control(No nitrogen), 20, 40 and 60 kg/ha of N and 40kg/ha of P and 20kg/ha of K was applied same to all plotsHalf of the nitrogen and full phosphate(40kg/ha) and potash(20kg/ha) dose were applied as basal and the rest of nitrogen was given as top dressing 25 days after sowing followed by earthing up. The soil of the experimental site was sandy loam with medium levels of organic matter (0.67%), low in available nitrogen (230 Kg/ha) and medium in both available phosphorus (30.8 Kg/ha) and potassium (180.3 Kg/ha). The soil was acidic in reaction (pH 5.46).Management operations were done as per recommended package of practices and observation on yield attributes and yield was taken.

4. Result and Discussion

Response of Genotypes on Yield and Yield Attributes

Yield of ricebean was influenced by genotypes and nitrogen levels. A wide variation was reflected among the ricebean genotypes in respect of yield and yield attributing characters (Table.3). Varieties BRBM 102 produced seed yield of 790.08 kg/ha which was 12.53%, 10.19 %, 10.35 %, 0.59 % and 10.50% higher than that of the genotypes RBL 01, RBL 06, RBL 35, Phulbani local and BRB 05 respectively. The highest seed yield of BRBM 102 might be due to more dry matter production, more leaf are index, more number of branches and more nutrient uptake by this genotypes [8]. This is also conformity with the finding of [9].

Stover yield is an indicator of vegetative growth of crop in terms of plant height, number of branches, number of leaves per plant and dry matter accumulation. The highest stover yield of 1941.42 kg/ha was recorded in variety RBL 01 which was 3.14 %, 0.025 %, 4.73 %, 0.75 %, 2.83 % higher than the variety RBL 06, RBL 35, Phulbani local, BRB 05 and BRBM 102 respectively. Significant variation in stover yield among various ricebean genotypes have been reported by [10].Maximum harvest index 29.76% was recorded in the variety Phulbani local indicating the ability of the variety to produce more seed than stover which might be due to better partitioning of photosynthates which ultimately resulted in higher grain yield. Variation in harvest index among different varieties was reported by [11].

Table 1: Mean no. of clusters/plant, pods/cluster & pods/plant at harvest of ricebean as influenced by variety and nitrogen

Genotypes	Clusters/ plant	Pods/ cluster	Pods/ plant
V1(RBL01)	17.56	3.40	61.40
V2(RBL06)	17.07	3.56	61.10
V3(RBL35)	17.76	3.43	61.64
V4(PHUBANI.L)	18.30	3.56	66.27
V5(BRB05)	18.46	3.63	67.29
V6(BRBM102)	17.18	3.61	61.38
SE m ±	0.041	0.023	0.061
CD(P=0.05)	0.092	0.052	0.136
Nitrogen(kg/ha)			
No(Control)	12.79	2.81	35.20
N1(20Kg/ha)	15.75	3.58	54.58
N2(40Kg/ha)	21.85	3.98	86.40
N3(60Kg/ha)	20.50	3.76	76.53
SE m ±	0.025	0.030	0.039
CD(P=0.05)	0.050	0.062	0.079

Table 2: Pod length (cm), seeds /pod and 1000 seed weight (g) at harvest of ricebean as influenced by variety and nitrogen

Genotypes	Pod length (cm)	Seeds/pod	1000 seed wt.(g)
V1(RBL01)	8.75	7.44	59.43
V2(RBL06)	8.88	7.60	59.88
V3(RBL35)	8.86	7.72	59.69
V4(PHUBANI.L)	9.06	7.56	59.52
V5(BRB05)	9.06	7.74	50.42
V6(BRBM102)	8.90	8.00	59.35
SE m ±	0.041	0.013	0.071
CD(P=0.05)	0.091	0.028	0.157
Nitrogen(kg/ha)			
No(Control)	7.68	6.90	54.73
N1(20Kg/ha)	8.80	7.74	58.56
N2(40Kg/ha)	9.61	8.19	62.37
N3(60Kg/ha)	9.58	7.88	56.53
SE m ±	0.053	0.043	0.044
CD(P=0.05)	0.107	0.087	0.090

The genotype BRB 05 recorded significantly higher number of clusters per plant (18.46), pods per plant(67.29) and pods per cluster(3.63) among the varieties tested (Table.1). Pod length 9.06 cm; mean number of seeds per pod 7.60 and 1000 seed weight 59.88 g was significantly superior in variety RBL 06 as compared to other varieties (Table.2). The superiority of variety RBL 06 might be due to high partitioning ability of photosynthates to the pods. Wide variation in the above characters among different varieties was observed by[12]. A quadratic response was observed by all the best variety due to increasing levels of nitrogen.

Effect of nitrogen on Yield and yield attributes

Application of 40 kg N/ha recorded significantly the highest seed yield of 865.06 kg/ha followed by 60 kg N/ha 808.83 kg/ha, 20 kg N/ha 698.22 kg/ha and no nitrogen 578.22 kg/ha (Table 3). Yield advantage of 40 kg N/ha was to the tune of 49.6 %, 23.89 %, 6.9 % over 0, 20, 60 kg/ha respectively. Higher seed yield of 40 kg N/ha could be due to better utilization ofnitrogen at this level. At 40 kg N/ha higher number of cluster per plant, pods per plant, seeds per pod and pod length were observed. All these yield attributing characters along with higher uptake of nutrients resulted in higher seed yield at 40 kg N/ha. Similar results have also been reported by [13]. Application of 60 kg N/ha decreased seed yield by 6.9% than that of the yield obtained at 40 kg N/ha. Decreased in seed yield with 60 kg N/ha was also reported by [14] .The variety BRBM 102 at 40 kg N/ha recorded the highest seed yield of 865.06 kg/ha which might be due to the ability of the variety to record higher yield under this level of nitrogen.

Maximum Stoveryield 2231.61 kg/ha was recorded with 40 kg N/ha which was at par with the stover yield 2226.61 kg/ha recorded at 60 kg N/ha. The increase in stover yield 40 and 60 kg N/ha could be due to more vegetative growth at nitrogen accelerated the process of cell division and cell enlargement resulting higher biomass production [15]. It was in confirmation with the findings of [4]

Application of 40 kg N/ha increased the harvest index than 20 kg and 60 kg N/ha.The number of pods per cluster, pods per plant and seeds per pod were increased significantly up to 40 kg N/ha. Similarly pod length and test weight were maximum at 40 kg N/ha. Further increase in nitrogen level decreased the value of these yield attributing characters. These results are in conformity with the findings of [16].

Table 3: Seed yield, Stover yield and Harvest index of ricebean as influenced by variety and nitrogen

Genotypes	*Seed yield (kg/ha)*	*Stover yield (kg/ha)*	*Harvest Index (%)*
V1(RBL01)	702.08	1941.42	26.56
V2(RBL06)	717.00	1882.25	27.59
V3(RBL35)	715.92	1940.92	26.94
V4(PHUBANI.L)	785.42	1853.58	29.76
V5(BRB05)	715.00	1926.83	27.06
V6(BRBM102)	790.08	1887.92	29.50
SE m ±	2.501	1.170	0.040
CD(P=0.05)	5.572	2.607	0.089
Nitrogen(kg/ha)			
No(Control)	578.22	1620.17	26.30
N1(20Kg/ha)	698.22	1943.56	26.42
N2(40Kg/ha)	865.06	2231.61	27.93
N3(60Kg/ha)	808.83	2226.61	26.46
SE m ±	3.731	5.485	0.056
CD(P=0.05)	7.566	11.124	0.115

Economics of Production

Ricebean genotype BRBM 102 at 40 kg N/ha produced the highest seed yield 865.06 kg/ha, net return (Rs.12947.00) and Benefit Cost ratio of 1.81(Table 4). The variety at 60 kg N/ha recorded the second highest yield (808.83 kg/ha), net return (Rs.10962.00) and a Benefit Cost ratio (1.00). The variety BRBM102 and Phulbani Local at 40 kg N/ha were found suitable for producing higher yield and economic return in the study.

Table 4: Economics of production as influenced by genotype

Genotypes		Yield of produce		Gross return (Rs. ha^{-1})			Cost of Cultivation (Rs. ha^{-1})	Net Return (Rs. ha^{-1})	Returned per rupee invested
		Seed (kg ha^{-1})	Stover (kg ha^{-1})	Seed	Stover	Total			
RBL01	V1N0	555	1532	13875	1532	15407	15430.00	-23	1.00
	V1N1	630	1752	15750	1752	17502	15686.50	1815.5	1.12
	V1N2	860	2374	21500	2374	23874	15943.00	7931	1.50
	V1N3	763	2106	19075	2106	21181	16199.40	4981.6	1.31
RBL06	V2N0	458	1215	11450	1215	12665	15430.00	-2765	0.82
	V2N1	570	1493	14250	1493	15743	15430.00	313	1.02
	V2N2	959	2513	23975	2513	26488	15686.00	10802	1.69
	V2N3	881	2308	22025	2308	24333	15943.00	8390	1.53
RBL35	V3N0	460	1249	11500	1249	12749	15430.00	-2681	0.83
	V3N1	580	1572	14500	1572	16072	15686.00	386	1.02
	V3N2	953	2583	23825	2583	26408	15943.00	10465	1.66
	V3N3	871	2360	21775	2360	24135	16199.00	7936	1.49
Phulbani L.	V4N0	482	1133	12050	1133	13183	15430.00	-2247	0.85
	V4N1	602	1444	15050	1444	16494	15686.50	807.5	1.05
	V4N2	1062	2496	26550	2496	29046	15943.00	13103	1.82
	V4N3	996	2341	24900	2341	27241	16199.40	11041.6	1.68
BRB05	V5N0	534	1442	13350	1442	14792	15430.00	-638	0.96
	V5N1	620	1674	15500	1674	17174	15686.50	1487.5	1.09
	V5N2	982	2636	24550	2636	27186	15943.00	11243	1.71
	V5N3	724	1955	18100	1955	20055	16199.00	3856	1.24
BRBM102	V6N0	493	1173	12325	1173	13498	15430.00	-1932	0.87
	V6N1	621	1478	15525	1478	17003	15686.50	1316.5	1.08
	V6N2	1054	2540	26350	2540	28890	15943.00	12947	1.81
	V6N3	992	2361	24800	2361	27161	16199.00	10962	1.00

Value of produce: Seed Rs.25.00 per kg. Stover: Rs.100.00 perquintal

Based on the above results and discussion, it can be concluded that ricebean genotype BRBM102 produced the highest seed yield. The varieties responded to application of 40kgN/haand produced maximum seed yield (865.06kg/ha), net return (Rs.12947.00) and Benefit: Costratioof1.81

5. Future Scope

As the experiment was conducted for one season, therefore more studies on response of promising rice bean genotypes to different levels of nitrogen are needed for selection of high yield genotypes with appropriate doses of nitrogen for realizing high productivity, profitability of ricebean and also sustainability in soil health and ecosystem. We will organize organoleptic tests for the most preferred common landraces, which will help strengthen the role of ricebean in the farming systems. If possible, we will also carry out a nutritional study of ricebean fodder and raise awareness about it among the community, both activities also suggested by the farmers.

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