International Journal of Chemical Science
Online ISSN: 2523-2843, Print ISSN: 2523-6075; Impact Factor: RJIF 5.22
Received: 03-08-2019; Accepted: 04-09-2019
www.chemicaljournals.com
Volume 3; Issue 6; October 2019; Page No. 14-17

To study the effect of fertilizer doses, organic manure and biofertilizers on energetics and economics of urdbean (*Vigna mungo* L.)

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Abstract
A field experiment entitled "Effect of fertilizer doses, organic manure and biofertilizers on yield and economics of urdbean (*Vigna mungo* L.)" was conducted during kharif season of 2017 at the Research cum Instructional Farm, under all India Coordinated Research Project on MULLaRP, Department of Agronomy, College of Agriculture, I.G.K.V. Raipur, Chhattisgarh. The urdbean var. Indira urd pratham was sown on 18th July, 2017 using experimental techniques of factorial randomized block design with three replications and sixteen treatments. The treatment consisted of four fertilizer doses, two organic manure and two biofertilizer treatments. Application of 100 % RDF, 5 t FYM ha^{-1} and rhizobium treatments recorded highest on energetics and economics of urdbean.

Keywords: urdbean, RDF, FYM, biofertilizer

Introduction

In India, pulses have been cultivated since time immemorial under rainfed situations which is characterized by poor soil fertility and moisture stress. These crops are energy rich but cultivated largely under energy starving situations. Unlike in cereals, varietal breakthrough in pulses has not been taken place. Pulses occupies 29.46 m ha area and contributes 22.95 mt production with an average productivity of 779 kg ha^{-1} (Anonymous, 2016-17). During the last four decades, the total area under pulses remained virtually stagnant (22 to 24 m ha) with almost stable production (12 to 14 mt), even though the population has been increased. As a result, per capita availability of pulses has been declined from 64 g day^{-1} in 1951-56 to less than 40 g day^{-1} as against WHO's recommendation of 80 g day^{-1} (Asthana and Chaturvedi, 1999) [2]. This situation led to the severe shortage of pulses in India, which has aggravated the problem of malnutrition in large section of vegetarian population of our country. Total pulse area in Chhattisgarh is 884.5 thousand hectares which contributes 527.1 thousand tonnes production with an average productivity of 476.1 kg ha^{-1}.

The factors attributed for low yields of pulses in India as compared to the world productivity are non- availability of quality seeds of improved and short duration varieties, growing of pulses under marginal and less fertile soil with low inputs and without pest and disease management, growing of pulses under moisture stress, unscientific post-harvest practices and storage under unfavourable conditions. Hence, there is a scope for improving the production potential of this crop by use of organic manures, inorganic manures and biofertilizers (Vadgave, 2010). Integrated nutrient management includes the intelligent use of organic, inorganic, and on-line biological resources so as to sustain optimum yields, improve or maintain the soil physical and chemical properties, and provide crop nutrition packages which are technically sound, economically attractive, practically feasible and environmentally safe. The existing state blanket recommendation for crops does not ensure efficient and economic use of fertilizers, as it does not take into account the fertility variations resulting in imbalanced use of fertilizer nutrients. Among the various methods of fertilizer recommendations, the soil test based fertilizer recommendations is also appropriate practices to improve yield as well as soil nutrient status (Gayathri *et al*., 2009) [4].

Urdbean is one of the most important pulse crops of India cultivated over a wide range of agro-climatic situations. The major urdbean growing states of the country are Maharashtra, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Tamilnadu, Karnataka and Rajasthan.

Leguminous crops are also responsive to balance dose of nutrient just like any other crop. Nutrient imbalance was one of the major abiotic constraints limiting productivity of pluses Masood *et al*. (2000) [7]. Application of biofertilzer recorded the the highest value of growth and yield attributes and yield of urdbean. It was observed that the plants treated with experimental biofertilizer Rhizobium showed excellent result in the morphological and bio-chemical parameters (Nalawde and Bhalerao, 2015). Application of FYM increases N, P, K content due to outcome of increased availability of nutrients to the plant upon decomposition of applied FYM (Vasanthi and Subramanian, 2004). FYM @ 5 t ha^{-1} in urdbean crop increase the available potassium content of soil after harvest of urdbean crop. The higher availability of potassium due to FYM may be ascribed to the reduction of K fixation and release of K due to the interaction of organic matter with clay (Tandon, 1987, Jagadeeshwari and Kumaraswamy (2000) [6]. Application of biofertilzer recorded the the highest value of growth and yield attributes and yield of urdbean. It was observed that the plants treated with experimental biofertilizer Rhizobium showed excellent result in the morphological and bio-chemical parameters (Nalawde and Bhalerao, 2015). Inoculation of urdbean seed with biofertilizer enhances available P status of soil by solublizing bound phosphate into available forms (Singh *et al*, 2008).

Traditionally, legumes have been viewed as excellent sources of nitrogen in agriculture (Kinzig and Socolow, 1994). It seems that production of nitrogen fertilizer represents the largest component of energy consumption for production among all chemical fertilizers (McLaughlin *et al*., 2000). Phosphorus is an essential component of cell structures, mainly as nucleic acids and phospholipids (Sinclair and Vadez, 2002). It is especially critical in establishing the enzymatic machinery in energy storage and transfer, which in many cases involves membrane processes. Not surprisingly, P deficiency results in a loss in cell integrity. The bonding properties of P also make it crucial for metabolic processes that are nucleotide-based, e.g., ADP, NAD and NADP, because of its unique energy-transfer properties. A general consequence of P deficiency is a decrease in the energy charge of cells. seed inoculation with *Rhizobium* culture increase plant height, number of primary and secondary branches plant^{-1}, number and dry weight of nodules plant^{-1}, seed and stover yield, nitrogen, zinc and molybdenum uptake, gross and net monetary return and benefit: cost ratio (Khan and Prakash, 2014).

Materials and Methods

The study was carried out at experiment field of Instructional cum Research Farm, Indira Gandhi Krishi Vishvavidhyalaya, Raipur, Chhattisgarh during *kharif* season of 2017-18. To study the effect of fertilizer doses, organic manure and biofertilizers on energetics and economics of urdbean (*Vigna mungo* L.). The soil of the experimental field was Vertisols with low, medium and high in N, P and K, respectively and neutral in reaction. The climate of the region is sub-humid to semi-arid. The experiment was laid out in Factorial Randomized Block Design having the combination of sixteen treatments and three replications. The treatment consisted of four levels of fertilizer doses that is F_1 -75%, F_2-100%, F_3-125% and F_4-150% RDF, two levels of organic manure control and 5 t FYM ha^{-1} and two levels biofertilizer rhizobium and LMn-16. Variety Indira urd Pratham was sown 18th July, 2017 with a seed rate of 20 kg ha^{-1}. The crop was harvested on 19th September 2018.

Result and Discussion

Energetics

Data calculated on energetic parameters of urdbean at harvest have been presented in Table 1. Data show that energy input and output as well as their efficiency was influenced by Fertilizer doses. The input energy of urdbean was recorded maximum (7257.41 MJ ha^{-1}) in 150%RDF, while it was minimum in case of lower RDF (75%) (5356MJ ha^{-1}). The maximum energy output (31950 MJ ha^{-1}) was recorded in 125%RDF.

Energy output input ratio

The highest output**:** input ratio (5.32) was observed in 100%RDF. There was a sharp decline in output-input ratio with every higher fertilizer doses of urdbean. The highest energy output: input and energy use efficiency might be due to more energy output and yields obtained under 100 %RDF. Similar findings were also observed with Choudhary and Kumar (2013) [3].

Energy output, and input energy were found maximum with application of 5t FYM ha^{-1}, however, energy output input ratio was

Table 1: Effect of fertilizer doses, organic manure and biofertilizers on energetics of urdbean

Treatment	Output Energy (MJ ha^{-1})	Input Energy (MJ ha^{-1})	Energy Output input Ratio	Energy use Efficiency (kgMJ ha^{-1})
Fertilizer doses (%RDF)				
F_1 75	27141.6	5356.41	5.07	0.13
F_2 100	31858.1	5990.08	5.32	0.14
F_3 125	31950.8	6623.75	4.82	0.13
F_4 150	28556.9	7257.41	3.93	0.10
FYM (t ha^{-1})				
M_1 0	25713.8	5306.91	4.85	0.13
M_2 5	34039.9	7306.91	4.66	0.12
Biofertilizers				
B_1 Rhizobium	30045.5	6306.91	4.76	0.12
B_2 LMn-16	29708.2	6306.91	4.71	0.12

Note: - RDF- 20:50:20:20 kg N: P2O5: K_2O: S ha^{-1}

Found higher with no application of FYM. Almost similar energy output input ratio values were found in both the biofertilizers treatment.

Energy use efficiency (kg /MJ×10^{-3})

The highest energy use efficiency (0.14) observed in 100%RDF. There was a sharp decline in energy use efficiency with every higher fertilizer doses of urdbean. The highest energy use efficiency might be due to more energy output and yields obtained under 100 % RDF. Similar findings observed with Choudhary and Kumar (2013) [3].

Energy output and input energy were found maximum with application of 5t FYM ha^{-1}, however, energy output input ratio and energy use efficiency was found higher with no application of FYM. As regards to biofertilizers, almost similar values of energy use efficiency were noted.

Economics

To examine the economic feasibility and viability of different treatments under investigation, cost of urdbean production (Rs. ha^{-1}), net return (Rs. ha^{-1}) and return Re^{-1} invested was computed and presented in Table 2. There is a conspicuous variation in the profitability due to various fertilizer doses, organic manure and biofertilizers levels.

As regards to the effect of fertilizer doses on economics, the cost of urdbean production enhanced with increase in fertilizer doses due to more cost (Rs.16186 ha^{-1}) involved in the higher dose of fertilizer 150% RDF.

Gross return (Rs ha^{-1})

The experimental plot fertilized with 125% RDF accrues the maximum amount of gross return (Rs.38976 ha^{-1}) and this economic indicator stand significantly higher followed by 100% RDF (Rs.38900ha^{-1}). Application of FYM 5 t ha^{-1} gave significantly higher gross return (Rs.41537 ha^{-1}). However, application of biofertilizers on gross return was found non-significant.

Interaction effects of fertilizer doses and FYM on gross return were found significant (Table 2.1). The interaction between 100%RDF with FYM 5 t ha^{-1} recorded significantly higher gross returns (Rs.44526.5 ha^{-1}) than others. But it was found at par to interaction between applications of fertilizer dose 150%RDF with 5 t ha^{-1} FYM and 75% RDF with 5 t ha^{-1} FYM (Rs. 38992 and 40530 ha^{-1}, respectively). The lowest gross return (Rs.25709.5 ha^{-1}) was noted under interaction between applications of 75% RDF with 0 t ha^{-1}.

Net return (Rs ha^{-1})

The experimental plot fertilized with 100% RDF accrues the maximum amount of net return (Rs.24048 ha^{-1}) and this economic indicator stand significantly higher followed by 125% RDF. Our results are in agreement with the findings of Singh (2008). The impact of treatments on improvement in seed and stover yield might have helped in obtaining higher profit. These observations substantiate the findings of Upadhyay *et al.* (2004) and Singh *et al*, (2008).

Application of FYM 5 t ha^{-1} gave significantly higher net return (Rs.25352 ha^{-1}). However, application of biofertilizers on net return was found non-significant.

Interaction effects of fertilizer doses and FYM on net return were found significant (Table 2.1). The interaction between 100% RDF with FYM 5 t ha^{-1} recorded significantly higher net return (Rs.28674.5 ha^{-1}) than others. But it was found at par to interaction between applications of fertilizer dose 125%RDF with 5 t ha^{-1} FYM and 75% RDF with 5 t ha^{-1} FYM (Rs.25580.5 and 25345 ha^{-1}, respectively). The lowest net return (Rs.12524.5 ha^{-1}) was noted under interaction between applications of 75%RDF x 0 t ha^{-1}.

Return Re^{-1} invested

The experimental plot fertilized with 100% RDF accrues the maximum amount of return Re^{-1} invested (2.6) and this economic indicator stand significantly higher followed by 125% RDF. Our results are in agreement with the findings of Singh (2008). The impact of treatments on improvement in seed and stover yield might have helped in obtaining higher profit. These observations substantiate the findings of Upadhyay *et al.* (2004).

Application of FYM 5 t ha^{-1} gave significantly higher return Re^{-1} invested (2.6). However, application of biofertilizers was found non-significant.

Interaction effects of fertilizer doses and FYM on return Re^{-1} invested were found significant. The interaction between 100% RDF with FYM 5 t ha^{-1} recorded significantly higher return Re^{-1} invested (2.8) than others. But, it was found at par to interaction between applications of fertilizer dose 75% RDF with 5 t ha^{-1} FYM (2.6). The lowest return Re^{-1} invested (1.9) was noted under interaction between application of 75%RDF with FYM 0 t ha^{-1}.

Table 2: Effect of fertilizer doses, organic manure and biofertilizers on economics of urdbean

Treatment	Cost of cultivation (Rs ha^{-1})	Gross Return (Rs ha^{-1})	Net return (Rs ha^{-1})	Return Re^{-1} invested
Fertilizer doses (%RDF)				
F_1 75	14185	33120	18935	2.31
F_2 100	14852	38900	24048	2.61
F_3 125	15519	38976	23457	2.51
F_4 150	16186	34844	18658	2.15
SEm $\pm$	-	1062	1062	0.07
CD(P=0.05)	-	3063	3063	0.2
FYM (t h^{-1})				
M_1 0	14186	31383	17197	2.21
M_2 5	16186	41537	25352	2.57
SEm $\pm$	-	751	751	0.05
CD(P=0.05)	-	2166	2166	0.14
Biofertilizers				
B_1 Rhizobium	15186	36660	21475	2.41
B_2 LMn-16	15186	36260	21074	2.38
SEm $\pm$	-	751	751	0.05
CD(P=0.05)	-	NS	NS	NS
Interection		S	S	S

Note: - RDF- 20:50:20:20 kg N: P2O5: K_2O: S ha^{-1}

Table 2.1: Interection effect of fertilizer doses and organic manure on gross income, net return and return Re^{-1} invested

	Gross return (Rs ha^{-1})			Net return (Rs ha^{-1})			Return Re^{-1} invested		
F X M	**FYM (kg ha^{-1})**			**FYM (t ha^{-1})**			**FYM (t ha^{-1})**		
RDF%	M_1	M_2	Mean	M_1	M_2	Mean	M_1	M_2	Mean
F_1 75	25709.5	40530.0	33119.8	12524.5	25345.0	18934.8	1.9	2.6	2.31
F_2 100	33274.0	44526.5	38900.3	19422.0	28674.5	24048.3	2.4	2.8	2.61
F_3 125	35852.5	42099.5	38976.0	23133.5	25580.5	23457.0	2.4	2.5	2.51
F_4 150	30695.0	38992.0	34844.0	15509.0	21807.0	18658.0	2.0	2.2	2.15
Mean	31382.7	41537.4		17197.2	25351.9		2.21	2.57	
SEm $\pm$	1501			1501.3			0.10		
CD (P=0.05)	4331			4331.2			0.28		

Note: - RDF- 20:50:20:20 kg N: P2O5: K_2O: S ha^{-1}

Conclusions

Urdbean crop responded well to the application of nutrient as the soils of the experiment field was average in nutrient status *viz.*, low in organic carbon content (0.31 %), low in available nitrogen content (216.6 kg ha^{-1}), medium in available phosphorus (11.4 kg P_2O_5 ha^{-1}) and high available potassium (361.2 kg ha^{-1}) contents. The result of Energetics and economic parameters were found maximum with 100% RDF, 5 t FYM ha^{-1} and rhizobium treatments and the interaction between 100% RDF and 5 t FYM ha^{-1} registered significantly highest net return and return Re^{-1} invested.

Reference

1. Anonymous. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, 2016.
2. Asthana AN, Chaturdevi SK. A little impetus needed. The Hindu Survey of Indian Agriculture, 1999, 61-65.
3. Choudhary VK, Kumar PS. Nutrient budgting,

economics and energetics f cowpea under potassium and phosphorus management. ICAR, Research Complex for North Eastern Hilly Region, Arunachal Pradesh Centre, Basar-791 101, India. SAARC J Agri. 2013; 11(2):129-140.
4. Gayathri A, Vadivel A, Santhi, R, Boopathi PM, Natesan R. Soil test based fertilizer recommendation under Integrated Plant Nutrition System for Potato (*solanum tuberosum*. L) In hilly tracts of nilgiris district. Indian J Agric. Res. 2009; 43(1):52-56.
5. Ghanshyam KR, Jat RK. Productivity and soil fertility as affected by organic manures and inorganic fertilizers in greengram (*Vigna radiata*) - wheat (*Triticum aestivum*) system. Indian J Agron. 2010; 55(1):16-21.
6. Jagadeeshwari PV, Kumaraswamy K. Long term effect of manure, fertilizer schedule on the yield and nutrient uptake by rice crop in a permanent manurial experiment. Journal of the Indian Society of Soil Science. 2000; 48:833-836.
7. Masood A, Mishra JP, Ali M. Nutrient management in pulses and pulses based cropping system. Fertilizer-News. 2000; 45(4):57-69.