Effect of Organic and Liquid Manures on Yield, Yield Attributes and Economic of Urdbean.

Abstract

A field experiment was carried out in 2020 kharif season, on loamy sand soil at the S.K.N. College of Agriculture's Agronomy Farm in Jobner (Rajasthan). It included two foliar sprays of each of four liquid manures (control, 100% RDP panchgavya @ 5%, 100% RDP vermiwash @ 10%, and 100% RDP cow urine @ 5%), totaling sixteen treatment combinations. It included four treatments of organic manures (control, 100% RDP through FYM, through vermicompost, and through poultry manure) and two foliar sprays of each of four liquid manures. Three replications of the experiment were set up using a Randomized Block Design. 'Krishna' variety of urdbean was sown as on July 13, 2020, a test crop with a 30-cm row spacing. The results showed that two foliar sprays of 5% panchgavya were the most effective liquid manure treatment in raising the maximum seed production (942 kg/ha), straw yield (2,121 kg/ha), and biological yield (3,063 kg/ha) of urdbean. The highest levels of nitrogen, phosphorous, and potassium were found in seed and straw under this liquid manure treatment, which was comparable to two foliar sprays of 10% vermiwash. However, applying 100% RDP through FYM was the most lucrative strategy, for obtaining higher yield, net returns of '36,314/ha and a B:C ratio of 2.68. Foliar spraying with 5% panchgavya also generated an extra 36,798/ha in net returns over the control, which had the highest B:C ratio of 2.37.

Keyword: Urdbean**,** liquid manure, net returns, organic manures.

Introduction

Urdbean [Vigna mungo (L.) Hepper] is India's third-most significant pulse crop. It comes from the wild plant Phaseolus sub lobatus and is indigenous to India. It is typically eaten in the form of "Dal." It is the main ingredient in "papad," "idly," and "dosa." It is high in phosphoric acid and contains protein (25%), carbs (60%), fat (1.3%), and fat. Pulses provide a significant fraction of the world's population with nutritional protein, and they also help to avert climate change by enhancing soil health because to their nitrogen-fixing abilities and by adding a lot of residue to the soil. The greatest user (29% of global consumption), producer (25-28% of global output), and importer of pulses worldwide is India. During the 2019–2020 growing season in India, pulses would occupy close to 29.36 million hectares, producing 23.02 million tonnes at an average productivity of 779 kg/ha (Anonymous, 2019-20).

It accounts for 10% of India's overall pulse production and 13% of the country's total pulse area. It is grown on an average of 655 kg/ha on an area of 5.44 mha in India, producing 3.56 mt (Anonymous, 2019). States with significant urdbean production include Madhya Pradesh, Rajasthan, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Maharashtra, Jharkhand, and Gujarat. Pulses are grown on a total of 38.42 lakh hectares in Rajasthan, where they are produced in 17,80 lakh tonnes at an average productivity of 463 kg/ha. In Rajasthan, urad

bean cultivation covers 0.95 million hectares, producing 0.34 million tonnes on an average per ha (Anonymous 2019-20). It is primarily farmed in dry and semi-arid regions of Rajasthan, including Jhalawar, Kota, Bundi, Baran, Chittorgarh, Udaipur, and Ajmer.

Among organic manures, FYM is a good source of plant nutrients, being high in organic matter and containing 0.5% N, 0.25% P, and 0.5% K as well as a variety of micronutrients in varying amounts. It breaks down into organic acids, which make nutrients available to plants in growth. It aids in protecting soils from abrupt chemical changes. Additionally, FYM serves as a source of energy for the expansion of soil bacteria.

Earthworms are used to create vermicompost, an organic source of nutrients that can be recycled from organic waste. It contains a lot of nutrients, including 7.61% Ca, 0.56% Mg, 0.11% Zn, and 1.33% Fe, as well as 1.67% N, 1.2% P, and 1.0% K. Along with adding organic carbon to the soil and aiding in the slow and efficient release of nutrients to the rooting zone of crop plants, it also contains a healthy proportion of exchangeable Ca, Mg, Na, and other elements.

Manure from poultry is largely resistant to microbial deterioration. However, due to its bulky character and the fact that inorganic fertilizer is so expensive, it is no longer within the means of farmers with little resources. It is necessary for creating and maintaining the best soil physical condition, which is required for plant growth (Rahman, 2004). In that order, it has 1.30 % N, 1 80 % P, and 0.80 % K.

Cow secretions like dung, urine, milk, curd, and ghee are used to make inexpensive, environmentally friendly organic fermented preparations called panchgavya and cow urine. Nitrogen, phosphate, potassium, magnesium, calcium, sulphate, and chloride are all abundant in cow urine. It is composed primarily of water (95%) and various minerals, including salts, enzymes, and urea (2.5%).In addition to acting as a plant hormone, it has been claimed to help plants that are lacking in certain micronutrients. It has a 6.8 to 21.1 g N content per liter (Nagar et al., 2016).

Numerous growth-regulating chemicals are present in vermiwash made from earthworm beds (Nielson, 1965). After water has passed through several layers of earthworm culture units, it is collected as a clear, pale yellow liquid extract of organic waste components. 1.34, 0.30, and 2.0% of N, P, and K, respectively, are present in vermiwash. As a foliar spray, it works incredibly well. Additionally, the earthworms' enzymes and secretions found in the vermiwash encourage crop development and productivity. Use of these organic liquid formulations will increase soil microbial population and activity to a greater level, which will benefit crop development and yield.

Materials and Methods

During the 2020 kharif season, a field experiment was carried out at the agronomy farm of the S.K.N. College of Agriculture, Jobner. Jobner is located 45 kilometres (km) west of Jaipur, at 26°05' North latitude, 75°28' East longitude, and 427 metres above mean sea level.

The region is located in Rajasthan's agro-climatic Zone-IIIa (Semi-arid Eastern Plain Zone). The data showed that the crop season saw 256.7 mm of rainfall, the majority of which was recorded in August. During the Urdbean growth season, the mean daily maximum and minimum temperatures varied from 30.2 to 40.9 C^0 and 14.3 to 25.4 C^0, respectively. Similar to that, the mean daily relative humidity ranged from 43% to 87%. There were between 1.8 and 8.0 hours of sunshine per day on average. Before layout, soil samples were collected from the experimental area in five random locations, ranging in depth from 0 to 15 cm. A representative composite sample was then created by combining and processing all of the soil samples. To determine its physico-chemical properties, the homogeneous composite soil sample underwent mechanical, physical, and chemical analyses. The experimental field had a loamy sand texture, a pH of 8.20, an EC of 1.41, an alkaline reaction, a poor organic carbon content of 0.15, a low available nitrogen level of 128.0, a medium available phosphorus content of 16.12, and a high potassium content of 153.4.

A drought-tolerant urdbean cultivar called Krishna was employed in the trial. The treatment consisted of 4 organic manures (control, 100% RDP through FYM,100% RDP through vermicompost & 100% RDP through poultry manure) and four liquid manures [Control, Panchgavya (two sprays at 5%), Vermiwash (two sprays at 10%), and cow urine (two sprays at 5%)] sixteen treatments, were used. This experiment was repeated three times. The trial field was extensively prepared by ploughing and then deep-plowing with a tractor-drawn disc plough. Following planking to achieve fine tilth, treatments such as well-rotted FYM, vermicompost, and poultry manure were applied and well assimilated into the soil. Using a hand plough and a seed rate of 20 kg/ha, the seeds were sown according to the "Kera" method, with a row spacing of 30 cm. Azospirillum was uniformly applied to crop seed at a rate of 750 g/ha, and VAM and Trichoderma were applied to soil at a rate of 5 kg/ha for all treatments. To enable the best plant population, thinning was carried out 15–20 days after sowing, with a 10 cm intra-row spacing. Through the sprinkler system, the crop received two life-saving irrigations. Using the battery-operated knapsack sprayer in the early morning and late at night, liquid manures, including panchgavya, vermiwash, and cow urine at 5%, 10%, and 5% respectively, and water at 500 l/ha, were sprayed twice: once at 25 DAS and again 15 days later at the flowering initiation stage. Vermiwash 50 liters/ha, panchgavya 25 liters/ha, and cow urine 25 liters/ha were the amounts of liquid manures used for each spraying. The crop was cut down on September 24, 2020, in order to evaluate the biological, seed, and stalk yields. Harvesting from the net plot area was completed after leaving two rows on each side

and 0.5 m across each row on both sides (3.0 m x 1.8 m). Bundles were hauled from each plot to the threshing floor for appropriate sun drying after being properly knotted and labelled.

Result

1.0 Yield attributes and yield

1.1 Number of pods/plant

Application of 100% RDP through vermicompost resulted in the significantly highest number of 24.4 pods/plant indicating an increase of 7.8 and 27.8 per cent over 100% RDP through FYM and control, respectively. Application of 100% RDP through vermicompost also attained 24.1 pods/plant and thus showed statistical equivalence with vermicompost in improving this trait of urdbean. The extent of increase due to 100% RDP through FYM in pods/plant was 18.5 per cent over control. Likewise in liquid manure, Two foliar sprays of 5% panchgavya or 10% vermiwash were the most superior and equally effective treatments in increasing the number of pods/plant. These two treatments attained 24.5 and 24.1 pods/plant that were 29.6 and 27.8 per cent higher than recorded under control. Two foliar sprays of 5% cow urine (22.84) was next in order where in an increase 20.9 per cent over control was obtained.

Number of seeds/pod

application of 100% RDP through vermicompost which was closely followed by application of 100% RDP through poultry manure being at par with each other, these two treatments enhanced the number of seeds/pod by 21.8 and 18.0 per cent over control, respectively. Application of 100% RDP through FYM also improved the seed/pods by 14.6 per cent than control and this was the next superior treatment in this respect. Were as with the application of liquid manure, The maximum number of 6.34 seeds/pod were recorded under two foliar sprays of 5% panchgavya which was accompanied in the order of two sprays of 10% vermiwash (6.28) and 5% cow urine (5.92). Being at par among themselves, these three treatments increased the number of seeds/pod to the extent of 22.4, 21.2 and 14.3 per cent, respectively over control.

Test weight

In case of organic manure with the application of 100% RDP through vermicompost was noted to record the highest test weight (33.9 g) which was closely followed by 100% RDP through poultry manure (33.76 g) and FYM (32.32 g). These treatments increase the test weight to the tune of 13.5, 13.1 and 8.2 per cent in comparison to control, respectively. However, these three treatments remained at par among themselves in improving this yield determining traits of urdbean. Also in case of liquid manure Two sprays of 5% panchgavya (34.07 g) and 10% vermiwash (33.79 g) were the most superior treatments in improving test weight. Being at par with each other, these treatments recorded 14.1 and 13.1 per cent higher test weight than control. On the other hand, two sprays of cow urine increased the test weight by 7.5 per cent than control.

Biological yield

Application of 100% RDP through vermicompost provided the significantly highest biological yield (3134 kg/ha) which was 12.7 and 39.7 per cent more than obtained under 100% RDP through FYM and control, respectively. Likewise, application of 100% RDP through poultry manure also increased the biological yield by 32.2 per cent than control and thus found at par with vermicompost treatment. Whereas, the increase in biological yield due to 100% RDP through FYM was to the tune of 23.0 per cent. With the use of liquid manure The maximum biological yield was obtained under two foliar sprays of 5% panchgavya which was closely followed by foliar spray of 10% vermiwash (2970 kg/ha) and 5% cow urine (2793 kg/ha). Being at par among themselves, these three treatments enhanced the biological yield to the extent of 33.4, 29.4 and 21.6 per cent, respectively over control.

The increased yield attributes and yield might be due the increased supply of the major nutrients nitrogen, phosphorus and potassium by translocation of the photosynthates accumulated under the influence of the organic manures. Further, the translocation and accumulation of photosynthates in the economic sinks, resulted in increased seed, straw and biological yield. Vermicompost not only increases organic carbon status of the soils but also the soil water holding capacity. Flocculation of soil and availability of all micro and macro nutrients making the soil and crop production sustainable one (Rajkhowa *et al*., 2002). Vermicompost helps in enhancing the activity of microorganism in soils resulting in enhanced solubility of nutrients and their consequent availability to plants by reducing soil pH at micro sites, chelating action of organic acids produced by them and intraphyl mobility in the fungal filaments (Chhonkar, 2002). The increased yield attributes and yield might be due the increased supply of almost all plant essential nutrients by translocation of the

photosynthates accumulated under the influence of the sources of organic nutrients. Vermicompost also attributed to the availability of sufficient amount of readily usable form of plant nutrients throughout the growth period and specially at critical periods of growth resulting in better plant uptake and higher yield attributes which ultimately led to higher yield. Further, the translocation and accumulation of photosynthates in the economic sinks, resulted in increased seed, straw and biological yields. Similar finding have also been and reported by Thiyageshwari *et al.* (2000), Yadav (2001) in cowpea, Rajkhowa *et al.* (2002) in greengram, Singh *et al*. (2008), Choudhary *et al.* (2011) in mungbean, Kannan *et al*. (2015) in blackgram, Meena *et al.* (2015) and Khan *et al.* (2017) in urdbean, Kumar *et al*. (2020) in blackgram.

4.4.4 Economics of the treatments

4.4.1 Net returns

Organic manures: All organic manure treatments greatly outperformed over control in terms of net returns. The most lucrative strategy application of 100% RDP through FYM highest net returns of ₹ 36,314/ha and the lowest net returns was found in control ₹ 26,277. 100% RDP through vermicompost enhanced the net returns by 23.7% over control, making it comparable to poultry manure.

Liquid manures: Due to the application of various liquid manures by foliar spray, net returns were also greatly increased. The two foliar sprays of 5% panchgavya yielded the highest net yields of ₹ 36,798/ha, which is a considerable increase of 11.1 and 47.2 percent over the two sprays of 5% cow urine and control, respectively. Statistics with panchgavya spray were shown after two foliar sprays of 10% vermiwash also produced increased net returns of ₹ 10,344 over the control. On the other side, a 5% spray of cow urine might boost net returns by 32.4% over control.

4.4.2 B:C ratio

Organic manures: The B:C ratio in urdbean was dramatically improved by applying several organic manures (Table 3). When 100% RDP was applied using FYM, the B:C ratio reached its peak at 2.68, which was 17.0% higher than control. 100% RDP through poultry manures was the next superior therapy in this regard, giving 2.25 rupees for every rupee invested.

Liquid manures: Different liquid manures applied to the leaves significantly improved the B:C ratio. The highest B:C ratio was recorded by a foliar spray of 5% panchgavya, which was closely followed by two foliar sprays of 10% vermiwash and 5% cow urine.

The most profitable amount of nutrients in urdbean were discovered to be from organic manures as vermicompost and poultry manure. A considerable improvement of 10.52 and 23.65 percent over 100% RDP through FYM and control, respectively, which was on par with 100% RDP through chicken manure, was achieved by vermicompost, yielding net yields of 32492/ha. Because this had a lower additional cost than 100% RDP by vermicompost, where the B:C ratio further decreased to 1.96, the highest B:C ratio was reached with 100% RDP with FYM (2.68). Both Kumar et al. (2013) and Kumawat et al. (2013) showed similar outcomes for mungbean and urdbean, respectively.

5.2.4 Economics

Spray of panchgavya twice on Urdbean had given higher net return (₹ 36798/ha) and B:C (2.37) ratio as compared to the control and other treatments (Table 3). The higher seed (942 kg/ha) and straw production (2121 kg/ha) under the two sprays of panchagvya in the current study can be used to explain the higher net return. Both groundnut and blackgram by Kumawat et al. (2009) and Somasudaram et al. (2009) reported similar outcomes.

Conclusion

The most effective method for increasing urdbean seed and straw yields (969 and 2165 kg/ha) was to apply 100% RDP using vermicompost. While the application of 100% RDP through FYM yielded the highest net returns of 36,314/ha with a B:C ratio of 2.68 due to the lower market price. The most effective treatments, however, were two foliar sprays of 5% panchgavya, which produced the highest seed and straw. (942 and 2,121 kg/ha) with the maximum net returns of ₹ 36,798/ha and B:C ratio (2.37) of urdbean

Table 1 : Effect of organic and liquid manures on yield attributes of urdbean

Treatments	Yield attributes		
	Number of pods/plant	Number of seeds/pod	Test weight (g)
Organic manures			
Control	19.11	5.22	29.86
100% RDP through FYM	22.65	5.98	32.32
100% RDP through vermicompost	24.42	6.36	33.90
100% RDP through poultry manure	24.13	6.16	33.76
SEm±	0.55	0.16	0.64
CD (P=0.05)	1.59	0.45	1.86
Liquid manures			
Control	18.88	5.18	29.87
Panchgavya (2 sprays @ 5%)	24.47	6.34	34.07
Vermiwash (2 sprays @ 10%)	24.13	6.28	33.79
Cow urine (2 sprays @ 5%)	22.84	5.92	32.11
SEm±	0.55	0.16	0.64
CD (P=0.05)	1.59	0.45	1.86
CV (%)	8.46	9.18	6.87

Table 2 :Effect of organic and liquid manures on seed, straw and biological yield of urdbean (kg/ha) and harvest index (%)

Treatments	Yield (kg/ha)			
	Seed yield	Straw yield	Biological yield	Harvest index (%)
Organic manures				
Control	679	1564	2243	30.27
100% RDP through FYM	845	1935	2780	30.39
100% RDP through vermicompost	969	2165	3134	30.91
100% RDP through poultry manure	929	2036	2965	31.33
SEm+	22	51	82	0.87
CD (P=0.05)	63	146	237	NS
Liquid manures				
Control	704	1592	2296	30.63
Panchgavya (2 sprays @ 5%)	942	2121	3063	30.73
Vermiwash (2 sprays @ 10%)	917	2052	2970	30.85
Cow urine (2 sprays @ 5%)	858	1935	2793	30.68
SEm+	22	51	82	0.87
CD (P=0.05)	63	146	237	NS
CV (%)	8.78	9.13	10.21	9.78

Table 3 : Effect of organic and liquid manures on net returns and B: C ratio of urdbean.

Treatments	Net returns (₹ /ha)	B: C Ratio
Organic manures		
Control	26,277	2.29
100% RDP through FYM	36,314	2.68
100% RDP through vermicompost	32,492	1.96
100% RDP through poultry manure	35,187	2.25
SEm+	9,79	0.06
CD (P=0.05)	2,827	0.17
Liquid manures		
Control	25,005	2.14
Panchgavya (2 sprays @ 5%)	36,798	2.37
Vermiwash (2 sprays @ 10%)	35,349	2.34
Cow urine (2 sprays @ 5%)	33,117	2.34
SEm+	979	0.06
CD (P=0.05)	2827	0.17
CV (%)	10.41	8.86

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