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Effect of standardisation of cow urine foliar spray on growth yield and economics of summer green gram (*Vigna radiata* L.)

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Abstract

The experiment was conducted to find out effect of cow urine foliar sprays on growth, yield and quality of summer green gram (*Vigna radiata* L.). Result show that The foliar spray of deshi cow urine at 20% concentration registered significantly maximum seed yield (9.98 q ha⁻¹) and straw yield at harvest (15.98 q ha⁻¹) than rest of the treatments. However, it was at par with treatment of foliar spray of deshi cow urine at 15% recorded seed and straw yield (9.51 q ha⁻¹) and (15.70 q ha⁻¹) respectively. The treatment without foliar spray (control) recorded significantly lowest seed and straw yield (7.53 q ha⁻¹) and (14.61 q ha⁻¹). The foliar application of deshi cow urine at 20% concentration at flowering and pod development stage of crop gave maximum gross monetary returns (51996 ₹ ha⁻¹), net monetary returns (16496 ₹ ha⁻¹) as well as benefit: cost ratio (1.46) than rest of the treatments.

Keywords: Cow urine, economics, green gram, seed yield, straw yield

Introduction

Pulses are commonly known as food legumes which are secondary to cereals in production and consumption in India. These are drought resistant and prevent soil erosion due to their deep root system and good ground cover hence; pulses are called as “Marvel of Nature”. The World Health Organization (WHO) recommends per capita consumption of pulses @ 80 g day⁻¹ and the Indian Council of Medical Research (ICMR) has recommended a minimum consumption of 47 g per day. The protein hunger is the major problem in the country, were majority of population adopt cereals and millet based dietary habits (Anonymous, 2020)^[1]. Considering the national scenario in India, green gram is cultivated on 32.67 lakh hectares with total production of 15.04 lakh tonnes. Whereas, in Maharashtra, area under green gram is 6.71 lakh hectares and its production are 3.71 lakh tones (Anonymous, 2020)^[1].

The productivity of pulse crop in India in general and especially green gram in particular is not enough to meet the domestic demands of ever-growing population. The potential yield of green gram is very low because of the fact that the crop is mainly grown under rainfed condition with poor management practices and also due to various physiological, biochemical as well as inherent factors associated with the crop. In spite of that productivity of crop is well below the average owing to several inherent soil related constraints such as low organic matter and poor soil fertility. As the plant nutrition is one of the most important factor responsible for poor growth and development of plants, method soil being low due to various losses and fixation (Latha and Nandansabababy, 2003)^[11].

Foliar spray of cow urine is recognized as an important method of fertilization, since foliar nutrients usually penetrate the leaf cuticle or stomata and enters the cell facilitating easy and rapid utilization of nutrient (Latha and Nandansabababy, 2003)^[11]. Liquid manures from cow urine are easy to make and is good for plants in comparison to artificial fertilizers (Kumar Vikram, 2018)^[7]. Future organic nutrient spray (cow urine) can be sprayed at critical growth stage of crop to overcome the problems of the slow release nutrients of organic sources affecting crop growth (Swayamprabha *et al.*, 2018)^[18]. Cow urine has antibacterial, antifungal, antiviral properties; hence it is the most effective secretion of animal origin with multipurpose therapeutic value, it also purifies and enhances soil fertility. However, cattle urine has a good manurial value and can be utilized as a biofertilizer (Ledgard *et al.*, 1982)^[12].

Day by day use of cow urine in organic farming is becoming very popular among the farmers due to its beneficial effects on crops. Secondly, most of the farmers were confusing and awaiting knowledge about whether to use deshi cow urine or exotic cow urine with what concentration as such information on green gram is still lacking. Therefore, an experiment was conducted to study effect of cow urine foliar sprays on growth, yield, and quality of summer green gram.

Materials and Methods

The field experiment was conducted during summer season in 2021 at Post Graduate Institute Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra (India). Farm is situated in between 19° 19' N to 19° 57' N latitude and between 74° 19'E to 74° 32'E longitudes. Subsequently the field was prepared in flat bed and have experimental plot was with gross plot size of 3.60 x 2.70 m. while net plot size was 3.40 x 2.10 m. The soil of experimental site was loamy in texture. Soil was low in available nitrogen (200.49 kg ha⁻¹), medium in available phosphorus (18.21 kg ha⁻¹), high in available potassium (419.04 kg ha⁻¹) and alkaline in reaction (pH 7.9). Green gram variety *Phule Chetak* was sown on 17.2.2021. The seeds were treated with *Rhizobium* culture @ 250 g 10 kg⁻¹ of seeds before sowing. The dibbling of seeds was done (2-3 seeds hill⁻¹). Light irrigation was given immediately after dibbling to ensure good germination and plant stand. The spacing between two rows was maintained at 30 cm and plant to plant at 10 cm. Gap filling was undertaken 9 DAS. One hoeing and one hand weeding were given to keep the plots weed free. The field experiment was laid out in Randomized Block Design with three replication and nine treatment combinations, consist of four foliar sprays of Deshi and Exotic cow urine. The treatment details T₁ Control (No spray), T₂ Foliar spray of deshi cow urine @ 5%, T₃ Foliar spray of deshi cow urine @ 10%, T₄ Foliar spray of deshi cow urine @ 15%, T₅ Foliar spray of deshi cow urine @ 20%, T₆ Foliar spray of Exotic cow urine @ 5%, T₇ Foliar spray of Exotic cow urine @ 10%, T₈ Foliar spray of Exotic cow urine @ 15% T₉ Foliar spray of Exotic cow urine @ 20%. The recommended dose of 20 kg N and 40 kg P₂O₅ ha⁻¹ was given as basal application before sowing to all the treatments. Fertilizers used were urea (46% N) and single super phosphate (16% P₂O₅) which were applied along the marked lines (i.e. line placement) 5 cm below the soil surface in the moist zone and then covered properly. First foliar spray deshi and exotic cow urine was applied at 5, 10, 15 and 20 percent at flowering as per treatment at 35 DAS on 15.3.2021 and subsequently second foliar spray was applied at flowering and pod formation stage as per the treatment at 50 DAS on 30.3.2021. Observations on the growth characters were recorded periodically, while observations of the seed yield, straw yield and yield contributing characters were recorded at harvest. All the data pertaining to the present investigation were statistically analyzed with RBD as given in the Gomez and Gomez (1984) [4]. The statistical analysis of plant characters was done by variance method (Panse and Sukhatme, 1978) [13].

Results and Discussion

Growth and growth attributing characters

Different foliar sprays showed a significant influence on various growth parameters of green gram viz., number of branches plant⁻¹, number of clusters plant⁻¹, weight of pods

plant⁻¹, number of seeds pod⁻¹, These growth parameters were significantly higher with spraying of 20% concentration of deshi cow urine than rest of foliar sprays at 56 and at harvest.

The treatment T₅ i.e. foliar spray of deshi cow urine at 20% concentration registered significantly higher length of pod (6.50 cm) than rest of treatments. However, it was at par with treatment of foliar spray of deshi cow urine at 15% at harvest stage (6.35 cm) of crop (T₄). The control treatment recorded minimum length of pod at harvest (6.02 cm). As a cow urine is good source of nitrogen and might be play vital role because of it is a major component of chlorophyll, the compound by with plant use sunlight energy to produce sugar from water and carbon dioxide help in increasing length of pod. These results are in conformity with Patil *et al.* (2010) [15], Desai *et al.* (2014) [3] and Chogare *et al.* (2019) [2]

The treatment T₅ i.e. foliar spray of deshi cow urine at 20% concentration found significantly higher number of clusters plant⁻¹ at harvest (4.50) stages, over rest of treatments. However, it was at par with treatment of foliar spray of 15% deshi cow urine at harvest (4.30) stage of crop. The control treatment recorded minimum clusters plant⁻¹ at harvest (3.50). The beneficial effects of nitrogen associated with higher photosynthetic activity and protein synthesis which promotes cell division and cell elongation that in turn accelerates the apical growth of main stem of green gram accelerates vegetative growth and results in increasing number of cluster plant⁻¹. Magnesium is the central core of the chlorophyll molecule in the plant tissue which results in increase a photosynthetic activity and results in increasing number of cluster plant⁻¹.

Foliar nutrition to pulse crop is very essential at flowering stage to arrest the flower dropping and also to induce the flowering. With increase in clusters plant⁻¹ the pod number increases. The foliar spray of liquid organic manures at flower initiation and 15 days after flowering (DAF) significantly enhanced the number of pods plant⁻¹.

Foliar spray of liquid organic manures at flower initiation and 15 days after flowering (DAF) significantly enhanced the number of clusters plant⁻¹. Foliar application of cow urine at 20% concentration significantly recorded the maximum number of clusters plant⁻¹. These results are close vicinity to those reported by Patil *et al.* (2010) [15] and Krishnaveni *et al.* (2020) [9].

Yield Attributes and yield

The yield attributing characters viz., 1000 seed weight (34.98 g), seed yield plant⁻¹ (2.81 g) were significantly influenced by spraying of deshi and exotic cow urine at different concentrations.

Increase in concentration of cow urine as foliar application significant yield attributing character increases. Foliar sprays of cow urine at 20% concentration (T₅) significantly increased seed yield plant⁻¹ (g) as well as increase the test weight due to phosphorus in plant found as constituents of nucleic acid, phospholipids, the coenzyme especially, NAD, NADP and very essentially as an important constituents of energy rich compounds results in increasing weight of grain ultimately increases test weight. The foliar spray cow urine significantly influences towards higher test weight These results are in conformity with Jegoda *et al.* (2018) [6] and Chogare *et al.* (2019) [2].

The foliar application of deshi cow urine at 20% concentration at flowering and pod development stage of crop

registered significantly maximum seed, straw and biological yield (9.98 q ha⁻¹), (15.98 q ha⁻¹) and (20.96 q ha⁻¹) respectively (T₅) than rest of other treatments. However, it was at par with treatment (T₄) of foliar spray of deshi cow urine at 15% (9.51 q ha⁻¹) (15.70 q ha⁻¹) and (20.21 q ha⁻¹) respectively. The treatment without foliar spray (control) recorded significantly lowest seed, straw and biological yield. Increased seed yield of green gram is due to cumulative effect of yield attributing characters, enhanced photosynthetic efficiency and improvement in the capacity of the reproductive sinks to utilize the incoming assimilates due to the foliar application of deshi and exotic cow urine at different concentration. The application of cow urine as foliar sprays increases primary and secondary branches and ultimately increased the number of pods plant⁻¹ which resulted in the increased seed yield. The beneficial effects of phosphorus might have helped in proliferating root growth which in turn absorbed more applied and native or biologically fixed nitrogen that resulted in more dry matter production which ultimately reflected in higher seed yield. Cow urine is good source of magnesium, nitrogen and potassium. Potassium is associated with the movement of water, nutrients and carbohydrates in plant tissue. It's involved with enzyme activation within the plant, which affects seed yield. Nitrogen plays a critical role within the plant to ensure energy is available when and where the plant needs it to optimize yield. Manganese (Mn) is an important micronutrient for plant growth and development and sustains metabolic roles within different plant cell compartments.

Manganese plays a key role in photosynthesis. Application of cow urine has been reported to have a favourable impact, for enhancing productivity of green gram. These results are in conformity with Patil and Dhonde (2005) [14], Krishnaprabhu *et al.* (2012) [8], Jadhav and Kulkarni (2013) [5], Singh *et al.* (2018) [17], Chogare *et al.* (2019) [2], Shivakumar *et al.* (2019) [16], Krishnaveni *et al.* (2020) [9], and Kumar *et al.* (2020) [10].

Economics studies

The gross monetary of green gram crop were influenced significantly due to foliar spray of deshi and exotic cow urine at different concentration. Treatment T₅ i.e. foliar spray of deshi cow urine at 20% concentration registered significantly higher gross monetary returns (₹ 51996 ha⁻¹), net monetary returns (₹ 16496 ha⁻¹) as well as B: C ratio (1.46) of green gram over rest of treatments. However it was statistically at par with treatment T₄ (foliar spray of deshi cow urine at 15% concentration) in both gross monetary returns (₹ 49571 ha⁻¹), net monetary returns (₹ 14946 ha⁻¹), as well as B: C ratio (1.43). The control treatment recorded significantly lower values of gross monetary returns ₹ 39350 ha⁻¹, net returns ₹ 7350 ha⁻¹ and benefit cost ratio (1.22). Favourable effects of cow urine application has been reported in enhancing the productivity of different crops and reducing cost of cultivation results in the benefit cost ratio value higher under foliar application of cow urine. This results in close vicinity to those reported by Jadhav and Kulkarni (2013) [5], Patel *et al.* (2016), Shivakumar *et al.* (2019) [16], Krishnaveni *et al.* (2020) [9] and Kumar *et al.* (2020).

Table 1: Growth and growth attributing characters influence by different treatments

Treatment	Number of clusters plant ⁻¹	Number of pods plant ⁻¹	Weight of Pods plant ⁻¹ (g)	Number of seeds pod ⁻¹	Length of pod (cm)	1000 Seed weight (g)
T ₁ : Control	3.50	12.28	2.70	6.15	6.02	32.23
T ₂ : Deshi cow urine @ 5%	3.87	13.01	3.02	6.03	6.25	34.80
T ₃ : Deshi cow urine @ 10%	4.00	13.59	3.19	6.08	6.29	35.30
T ₄ : Deshi cow urine @ 15%	4.30	14.01	3.32	6.11	6.35	36.20
T ₅ : Deshi cow urine @ 20%	4.50	14.45	3.59	6.14	6.50	37.63
T ₆ : Exotic cow urine @ 5%	3.80	12.62	2.72	5.98	6.18	33.70
T ₇ : Exotic cow urine @ 10%	3.90	12.93	3.06	6.03	6.28	34.70
T ₈ : Exotic cow urine @ 15%	4.00	13.24	3.12	6.05	6.34	35.00
T ₉ : Exotic cow urine @ 20%	4.20	13.65	3.21	6.07	6.39	35.35
S.Em. +	0.08	0.16	0.10	0.07	0.50	0.48
C.D. at 5%	0.24	0.48	0.30	NS	NS	1.45

Table 2: Yield and yield attributing characters influence by different treatments

Treatment	Seed yield plant ⁻¹ (g)	Seed yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)	Biological yield (q ha ⁻¹)	Harvest index (%)
T ₁ : Control	2.43	7.53	14.61	17.04	44.19
T ₂ : Deshi cow urine @ 5%	2.73	8.38	15.03	18.41	45.51
T ₃ : Deshi cow urine @ 10%	2.91	8.96	15.37	19.33	46.35
T ₄ : Deshi cow urine @ 15%	3.09	9.51	15.70	20.21	47.05
T ₅ : Deshi cow urine @ 20%	3.23	9.98	15.98	20.96	47.61
T ₆ : Exotic cow urine @ 5%	2.54	7.82	14.69	17.51	44.66
T ₇ : Exotic cow urine @ 10%	2.70	8.26	14.85	18.21	45.35
T ₈ : Exotic cow urine @ 15%	2.80	8.54	15.02	18.66	43.43
T ₉ : Exotic cow urine @ 20%	2.92	8.90	15.24	19.24	46.25
S.Em. +	0.05	0.18	0.12	0.27	0.70
C.D. at 5%	0.15	0.54	0.36	0.81	NS

Table 3: Economic studies of green gram as influenced by different treatments

Treatment	Gross monetary returns (₹ ha ⁻¹)	Cost of cultivation (₹ ha ⁻¹)	Net monetary returns (₹ ha ⁻¹)	B:C ratio
T ₁ : Control	39350	32000	7350	1.22
T ₂ : Deshi cow urine @ 5%	43741	32875	10866	1.33
T ₃ : Deshi cow urine @ 10%	46733	33750	12983	1.38
T ₄ : Deshi cow urine @ 15%	49571	34625	14946	1.43
T ₅ : Deshi cow urine @ 20%	51996	35500	16946	1.46
T ₆ : Exotic cow urine @ 5%	40851	32625	8601	1.25
T ₇ : Exotic cow urine @ 10%	43121	33250	9871	1.29
T ₈ : Exotic cow urine @ 15%	44566	33875	10691	1.31
T ₉ : Exotic cow urine @ 20%	46242	34250	11992	1.35
S.Em. +	837	-	525	-
C.D. at 5%	2511	-	1575	-

Conclusion

On the basis of one season of experiment, it could be concluded that, foliar application of deshi cow urine at 20% concentration at flowering and pod development stage of crop with recommended dose of fertilizer (20:40:00 NPK kg ha⁻¹) found suitable for achieving maximum seed yield as well as monetary benefits of summer green gram

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