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# Effect of liquid organic sources on growth, yield and quality of mungbean [*Vigna-radiata* (L.)] under agroclimatic zone IIIA

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**Abstract**
The field experiment was conducted at Agricultural Research Farm, School of Agriculture, Suresh Gyan Vihar University, Jaipur (Rajasthan) during *Kharif* 2023 on clay loam soil to study the "Effect of Liquid Organic Sources on Growth, Yield and Quality of Mungbean [*Vigna-radiata* (L.)] Under Agroclimatic Zone IIIA" which was laid out in randomized block design with three replications. The experiment comprised of tenth treatments *viz*. $T_0$ Control, $T_1$ Foliar application of Jeevaamrit @ 5%, $T_2$ Foliar application of Jeevaamrit @ 7.5%, $T_3$ Foliar application of Jeevaamrit @ 10%, $T_4$ Foliar application of Panchagavya @ 2%, $T_5$ Foliar application of Panchagavya @ 4%, $T_6$ Foliar application of Panchagavya @ 6%, $T_7$ Foliar application of Vermiwash @5%, $T_8$ Foliar application of Vermiwash @10%, $T_9$ Foliar application of Vermiwash @ 15%. In this experiment application of different liquid organic sources were applied to the mungbean variety "RMG-975". A critical examination of data revealed that significantly higher plant height (43.61, 63.55 at 50 DAS and at harvest), number of branches/plant (4.88, 5.33 at 50 DAS and at harvest), chlorophyll content (2.70 and 2.11 mg/g at 30 and 60 DAS), plant dry weight (1.99, 12.66 and 19.40 g/plant at 25, 50 DAS and at harvest) were observed in application of $T_6$ (Foliar application of Panchagavya @ 6%) over control. Application of Foliar application of Panchagavya @ 6% was recorded significantly higher number of pods/plant (20.44), seeds/pod (9.66), seed yield (1190 kg/ha), straw yield (2528 kg/ha) and biological yield (3718 kg/ha) as compared to over rest of treatments. It can be inferred from the economic assessment of data that all the different organic liquid formulation treatments recorded significantly higher gross return (109424 Rs/ha) and net return (78734 Rs/ha) was recorded in application of $T_6$ Foliar application of Panchagavya @ 6% as compared to over rest of treatments, while significantly higher B:C ratio (2.68) was recorded in application of $T_4$ Foliar application of Panchagavya @ 2%.

**Keywords:** Mungbean, Panchagavya, vermiwash, jeevamrit

## 1. Introduction
Greengram (*Vigna radiata*) is one of the important legume plants of the pulse family (Fabaceae). It is commonly known as mungbean, mungo, Oregon pea, or simply mung and is also cultivated as a green manure crop. It is grown as a catch crop in between the *kharif* and *Zaid* seasons and is one of India's major *kharif* pulse crops. Its seed is more palatable, nutritive, digestible, and non-flatulent than other pulses grown in the world. The seed of Greengram contains an average of 20-24% protein, 62.5% carbohydrates, 1.4% fat, 4.2% fiber, vitamins, and minerals" (Sehrawat *et al*. 2013) [19]. "It provides enough fibers and iron hence becomes easily digestible. Because of its short growing time, which allows it to fit into intercropping systems with diverse crops, high tonnage capacity, and exceptional nutritional properties for food, feed, and forage, it has a wide range of adaptations. In second generation world, pulses are frequently referred to as "poor man's meat" since they are less expensive than meat" (Patel *et al*. 2020) [14]. "India is the major producer of Greengram in the world, and is grown in almost all the states. It covers an area of 40.38 lakh hectares with a total production of 31.5 lakh tonnes with a productivity of 783 kg/ha and contributes 11% of the total pulse production in the year 2021-22. Some of the states like Rajasthan (20.89 lakh/ ha), Madhya Pradesh (1.57 lakh/ ha) and Uttar Pradesh (0.30 lakh/ha) are

the major producer of Greengram in India" (GOI, 2021) [7].

Organic farming as a sustainable production management system provides long-term benefits to people and the environment (Hans, 2014) [8]. It is not new in India but it has been practiced since immemorial. Organic farming is a unique production management system which promotes and enhances agro-ecosystem health including biodiversity, biological cycles and soil biological activity and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs (*viz*. fertilizers, pesticides, hormones and feed additives) and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection (Raahinipriya and Rani, 2018) [16].

The soil application of organic manure and foliar sprays of liquid manure during crop growth period significantly enhances the seed yield and seed quality parameters of Greengram. Use of organic manure alone or in combination with liquid organic manure will help to improve soil physico-chemical properties and the effective utilization of applied organic manure for improved seed yield and seed quality (Singh *et al.* 2017) [21]. "Foliar application of liquid fertilizer supplies plant nutrients more rapidly than methods involving uptake by root due to seed/root treatment. Foliar application of nutrients play a vital role in pulse production by stimulating root development, various metabolic processes, translocation activity in plants and pod setting, thereby increases the yield" (Mononmani and Srimathi 2009) [11]. An organic compound called Panchagavya can strengthen plant systems by fostering development and immunity (Jegode *et al.*2019) [9]. The application of Panchagavya as foliar spray considerably enhances the quantity of pods on each Greengram plant, hence directly contributing to larger crop production (Singh *et al.* 2022) [20]. Liquid organic fertilizers (Panchagavya, vermiwash and jeevaamrit) are useful for achieving higher agricultural production, because the extract contains growth promoting hormones, IAA, IBA, Cytokinin, Gibberellin, trace elements, vitamins, amino acids, antibiotics, and micronutrients. The adequate availability of organic manures in bulk, selection of suitable improved variety with solid and liquid organic manures that adapts itself under the peculiar climatic condition of Agroclimatic Zone IIIA for sustainable organic production of mungbean. Therefore, keeping the above facts in view, the objective of present study was therefore to evaluate, effect of liquid organic sources on growth, yield and quality of mungbean.

## 2. Materials and Methods

The soil of the experimental field was clay loam, having BD (1.18), PD (2.64), Porosity (55.30), organic carbon (0.46%), pH (7.6), EC (0.35 dS/m), available N (305.20 kg/ha) available $P_2O_5$ (22.11 kg/ha) available $K_2O$ (335.50 kg/ha). The experiment was laid out in randomized block design with three replications and comprised of tenth treatments with different organic formulation, solid organic manures *viz*., farmyard manure and liquid organic manures *viz*., Panchagavya, vermiwash and jeevamrit sprayed on mungbean crop at 30 and 45 days. Mungbean variety RMG-975 was sown in 30 cm apart at a seed rate of 20 kg seed/ha on the third fourth night of July. The crop was thinned 15 days after sowing to maintain a plant to plant spacing of 10 cm. The recommended cultural practices and plant protection measures were followed to raise the healthy crop. The crop was generally manually harvested in the first week of October. In order to test the significance of variation in experimental data obtained for various treatment effects, the data were statistically analysed as described by Panse and Sukhatme (1985) [13].

*Panchgavya* was prepared with a mixture of five components in the ratio of 5:4:3:2:1, *viz.*, cow dung, cow urine, milk, curd, ghee, tender coconut water and six ripe bananas. first of allow dung and cow ghee mix in plastic drum and kept it for 3 days then after mix remain ingredient were mixed and keep it for 21 days. Jeevamrit was prepared with a mixture of five components (fresh cow dung 25 kg, 5-10 lit. cow urine, 2 kg jiggery, 2 kg chickpea flour and 1 kg sajiv soil (Soil below baniyan tree) for one acre use one time added in 200 lit. water. All the items added to a wide mouthed plastic tank having a capacity of 300 liters. The container should be kept under shade. This mixture is to be stirred twice a day in clock wise direction both in morning and evening. The Jeevamrut stock solution will be ready after 7 days. Vermiwash is a liquid extract obtained from vermicomposting process and used as an organic fertilizer for crop plant. To maintain the moisture level of cow dung kept in plastic tank, water is sprinkled to the vermicompost heap drop by drop. The earthworms eat up and digested the wet organic waste and thus some amount of water absorb by the earthworms. During vermicomposting process drained continue nutrient enrich solution from vermi-bed or heap in a pot generated wash which is an extract of not only earthworm-worked biomass but also the earthworm body fluids. This yellowish liquid released by the earthworms is known as vermiwash. Beejamrut was prepared with a mixture of five components in the ratio of 1:5:5:0.5:0.1:0.025, *viz.*, water, cow dung, cow urine, milk, lime and sajiv soil respectively, (for treating 100 kg seeds) which was fermented for 12 hours, then the seeds of mungbean were treated with filtered beejamrut @ 50 to 100 ml/kg for 5-7 minutes.

## 3. Results and Discussion

A critical examination of data revealed that application of liquid organic sources significantly enhanced growth parameters all successive growth stages. Data referred that liquid organic sources significantly influenced the plant height (43.61), number of branches/plant (4.88), chlorophyll content (2.70 mg/g) and plant dry weight (12.66 g/plant) of mungbean over control. Significantly higher plant height, number of branches/plant, chlorophyll content and plant dry weight were recorded in application of $T_6$ Foliar application of Panchagavya @ 6% over control. Maximum plant height, number of branches/plant, chlorophyll content and plant dry weight were recorded with application of $T_6$ Foliar application of Panchagavya @ 6% remained statistically on par with $T_5$ Foliar application of Panchagavya @ 4%, $T_4$ Foliar application of Panchagavya @ 2% and $T_9$ Foliar application of vermiwash @ 15% and $T_8$ Foliar application of vermiwash @ 10% whereas, $T_7$ Foliar application of vermiwash @ 5% observed at 50 DAS plant height . The increase in plant height due to organic inputs might be growth attributed to increase in the availability of cytokinine to shoot which in turn play a role in cell elongation process either through cell division or cell elongation. Similar results have been reported by Bacchav *et al*., (1996) [2] and Patil and Udmale (2016) [15]. Increase number of branches/plant might be due to availability of proportionate quantity of nutrients and organic formulation supplied sufficient quantity of phosphorus and other essential nutrient, these findings are in accordance with the results of Bish and Chandel 1991 [3]; Babhulkar 2000 [1]. The different solid and liquid forms of organic manures certainly played a role in steady release of nitrogen, iron and magnesium *etc*, which lead to the synthesis of chlorophyll content in an

enhanced manner in mungbean leaves. Application of organic manures such as Farmyard manure along with two spray of panchagavya and vermiwash this is balance supply of nutrient resulted in greater amount of chlorophyll a, b and total chlorophyll content thus the practical consequence of this effect is self-explanatory that other factors being favorable the greater amount of the solar energy utilized under optimum environmental condition will contribute to accumulation due to their greater photosynthesis capacity and convert to higher dry matter production thereby increased crop growth rate of mungbean these results corroborate the finding Nagar *et al*., (2016) [12]; Elicin *et al*., (2021) [5].

A perusal of data revealed that application of different organic sources significantly influenced yield attributes, yield and quality. Application of $T_6$ Foliar application of Panchagavya @ 6% was recorded significantly higher number of pods/plant (20.44) and seeds/pod (9.66), seed yield (1190 kg/ha), straw yield (2528 kg/ha), biological yield (3718 kg/ha) and protein content (24.75%) as compared to over rest of treatments. Significant and maximum number of pods/plant and seeds/pod was recorded due to application of $T_6$ Foliar application of Panchagavya @ 6% over control and remained statistically on par with $T_5$ Foliar application of Panchagavya @ 4% and $T_4$ Foliar application of Panchagavya @ 2%, $T_9$ Foliar application of vermiwash @ 15% and $T_8$ Foliar application of vermiwash @ 10%. Significant and maximum seed yield of mungbean was recorded due to application of $T_6$ Foliar application of Panchagavya @ 6% over control and remained statistically on par with $T_5$ Foliar application of Panchagavya @ 4% and $T_4$ Foliar application of Panchagavya @ 2%. Significant and maximum biological yield of mungbean was recorded due to application of $T_6$ Foliar application of Panchagavya @ 6% over control and remained statistically on par with $T_5$ Foliar application of Panchagavya @ 4% and $T_4$ Foliar application of Panchagavya @ 2%, $T_9$ Foliar application of vermiwash @ 15%, $T_8$ Foliar application of vermiwash @ 10%, $T_7$ Foliar application of vermiwash @ 5% and $T_3$ Foliar application of Jeevaamrit @ 10%. It indicates that the increased availability of nutrients can affect the yield attributes and yields. Most nutrients are found continuously available in FYM and liquid organic manures such as nitrates, phosphates, soluble potassium as well as micronutrients, it has the highest potassium element compared to other manures, which is 1.2% where the potassium element functions to transport assimilated products in the form of photosynthate which is channeled into the pit in the form of pods, these results are in close conformity with the findings of Rahayu, *et al*., (2021) [17]. Combined application of solid and liquid organic manures is quite obvious, as these provide a steady supply of nutrients leading better growth of plants. Moreover, the increased availability of P and K in addition to other plant nutrients released by the organic manures might have contributed in enhancing the yield attributes. The positive impact of availability of individual plant nutrients and humic substances from manure and balanced supplement of nitrogen through liquid organic manures might have induced cell division, expansion of cell wall, meristematic activity, photosynthetic efficiency and regulation of water intake into the cells, resulting in the enhancement of overall growth and development. The overall growth and development of crop is reflected in the development of yield contributing characters which affect the final yield of the crop as these parameters are positively correlated to seed yield. Yield is the synthesis and outcome of physiological biochemical process. The results corroborate with the findings of Verma *et al*., (2017) [22].

It can be inferred from the economic assessment of data that all the liquid organic sources treatments recorded significantly higher gross return (₹109424), net return (₹78734) was recorded in application of $T_6$ Foliar application of Panchagavya @ 6% as compared to over rest of treatments. Significant and maximum gross return and net return of mungbean was recorded due to application of $T_6$ Foliar application of Panchagavya @ 6% over control and remained statistically on par with the application of $T_5$ Foliar application of Panchagavya @ 4%, $T_4$ Foliar application of Panchagavya @ 2% and $T_9$ Foliar application of vermiwash @ 15% and $T_8$ Foliar application of vermiwash @ 10% in net return. Data show that application of $T_4$ Foliar application of Panchagavya @ 2% significantly higher B: C ratio (2.68). Though variability existed between treatments, inferiority of $T_5$ Foliar application of Panchagavya @ 4% and $T_1$ Foliar application of Jeevaamrit @ 5% as compared to rest of the treatments was observed. Data further showed that maximum B: C ratio was obtained by application of $T_4$ Foliar application of Panchagavya @ 2% (2.68) followed by $T_5$ Foliar application of Panchagavya @ 4% (2.65) and closely followed by $T_6$ Foliar application of Panchagavya @ 6% (2.57) which gave significantly higher benefits over rest of the treatments. The cost of integration of organic manure (solid organic manure + liquid organic manure) was compensated with the higher yield of mungbean similar results were also reported by Verma *et al*., (2017) [22].This trend in economic return is mainly due to the higher cost and treatment effect on the seed and haulm yield of mungbean. Similar findings were respected by Ramesh *et al*., (2010) [18], Chaturvedi *et al*. (2012) [4], Konthoujam *et al*., (2013) [10] and Gharpinde *et al*. (2014) [6].

**Table 1:** Effect of liquid organic sources on growth parameters and yield attributes of mungbean

| Treatment | | Mungbean growth parameters and yield attributes | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Plant height (cm) at 50 DAS | Branches/plant at 50 DAS | Chlorophyll (mg/g) at 30 DAS | Plant dry weight at 50 DAS (g/plant) | Number of pods/plant | Number of seeds/pod | Test weight (g) |
| $T_1$ | Control | 27.22 | 3.11 | 1.46 | 8.03 | 13.00 | 5.11 | 31.33 |
| $T_2$ | Foliar application of Jeevamrit @ 5% | 33.34 | 3.89 | 1.78 | 9.67 | 16.33 | 6.44 | 32.23 |
| $T_3$ | Foliar application of Jeevamrit@7.5% | 35.92 | 4.00 | 1.82 | 10.00 | 17.00 | 6.77 | 32.33 |
| $T_4$ | Foliar application of Jeevaamrit @ 10% | 36.44 | 4.07 | 1.88 | 10.60 | 17.22 | 6.89 | 32.34 |
| $T_5$ | Foliar application of Panchagavya @ 2% | 41.21 | 4.44 | 2.50 | 11.73 | 19.33 | 8.89 | 32.79 |
| $T_6$ | Foliar application of Panchagavya @ 4% | 43.00 | 4.55 | 2.58 | 11.93 | 19.89 | 9.11 | 32.90 |
| $T_7$ | Foliar application of Panchagavya @ 6% | 43.61 | 4.88 | 2.70 | 12.66 | 20.44 | 9.66 | 33.01 |
| $T_8$ | Foliar application of Vermivash @ 5% | 39.78 | 4.15 | 1.90 | 11.17 | 17.44 | 7.33 | 32.45 |
| $T_9$ | Foliar application of Vermivash @10% | 40.44 | 4.26 | 2.25 | 11.47 | 18.55 | 8.55 | 32.57 |
| $T_{10}$ | Foliar application of Vermivash @ 15% | 40.55 | 4.33 | 2.36 | 11.60 | 19.22 | 8.66 | 32.68 |
| S.Em ± | | 1.356 | 0.235 | 0.084 | 0.442 | 0.817 | 0.401 | 0.313 |
| CD (P=0.05) | | 4.03 | 0.70 | 0.25 | 1.31 | 2.43 | 1.19 | NS |
| CV (%) | | 6.16 | 9.77 | 6.82 | 7.03 | 7.94 | 8.97 | 1.67 |

**Table 2:** Effect of liquid organic sources on yield, quality and economics of mungbean

| Treatment | | Seed yield (kg/ha) | Straw yield (kg/ha) | Biological yield (kg/ha) | Protein content (%) | Gross return (₹/ha) | Net return (₹/ha) | B:C ratio |
|---|---|---|---|---|---|---|---|---|
| $T_1$ | Control | 657 | 1576 | 2233 | 21.33 | 60926 | 37836 | 1.64 |
| $T_2$ | Foliar application of Jeevamrit @ 5% | 930 | 2153 | 3083 | 22.65 | 86047 | 58657 | 2.14 |
| $T_3$ | Foliar application of Jeevamrit@7.5% | 1012 | 2315 | 3327 | 22.95 | 93551 | 66011 | 2.40 |
| $T_4$ | Foliar application of Jeevaamrit @ 10% | 1050 | 2375 | 3425 | 23.22 | 96983 | 69293 | 2.50 |
| $T_5$ | Foliar application of Panchagavya @ 2% | 1130 | 2455 | 3585 | 24.28 | 104070 | 75780 | 2.68 |
| $T_6$ | Foliar application of Panchagavya @ 4% | 1168 | 2511 | 3679 | 24.53 | 107519 | 78029 | 2.65 |
| $T_7$ | Foliar application of Panchagavya @ 6% | 1190 | 2528 | 3718 | 24.75 | 109424 | 78734 | 2.57 |
| $T_8$ | Foliar application of Vermivash @ 5% | 1057 | 2362 | 3419 | 23.45 | 97545 | 69855 | 2.52 |
| $T_9$ | Foliar application of Vermivash @10% | 1075 | 2381 | 3456 | 23.83 | 99143 | 70853 | 2.50 |
| $T_{10}$ | Foliar application of Vermivash @ 15% | 1094 | 2398 | 3492 | 24.08 | 100818 | 71928 | 2.49 |
| S.Em ± | | 31.94 | 70.08 | 102.02 | 0.231 | 2944 | 2944 | 0.10 |
| CD (P=0.05) | | 94.91 | 208.22 | 303.10 | 0.69 | 8747 | 8747 | 0.30 |
| CV (%) | | 5.34 | 5.27 | 5.29 | 1.70 | 5.33 | 7.53 | 7.37 |

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