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Influence of Natural Liquid Organics on Morphology and Growth Attributes of Blackgram (*Vigna mungo* L.)

Y. Bhargavi, P. Sudhakar, V. Raja Rajeswari, T. Giridhara Krishna

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ABSTRACT

Background: Heavy use of chemicals in agriculture has weakened the ecological base and caused the degradation of soil, water resources and quality of the food. The increasing cost and unavailability of fertilizers, growing ecological concern has forced us to try new methods of application of nutrients. Natural farming is the new method introduced as a holistic alternative to the present chemical input based agriculture. There has been increasing interest in the use of panchagavya, beejamrutha, jeevamrutha and other liquid organic formulations during the recent years. Therefore, there is a need to compare the efficiency of natural liquid organics and the regular chemical fertilizers. Hence, the present investigation is taken up with the aim to study the effect of different foliar spray of organics on growth of blackgram.

Methods: A field experiment was conducted at the dryland farm, S.V. Agricultural College, Tirupati during *Kharif*, 2017 to study the effect of foliar sprays of different natural liquid organics on morphological and growth attributes of blackgram.

Result: The results indicated that RDF (recommended dose of fertilizers) recorded significantly maximum plant height, leaf area, dry matter, seed yield and other yield attributes over the foliar spray of liquid organics. Results further revealed that significantly lower plant height, dry matter were recorded in the treatment receiving seed treatment with beejamrutha. No significant difference in terms of days to 50% flowering was observed among the treatments. Significantly higher emergence index was recorded in the treatments receiving seed treatment with beejamrutha and water. Integrated use of organics has recorded significantly more number of root nodules compared to other treatments. Jeevamrutha foliar spray recorded to be superior over panchagavya foliar spray which was attributed to the presence of micronutrients in jeevamrutha.

Key words: Beejamrutha, Blackgram, Jeevamrutha, Panchagavya.

INTRODUCTION

Black gram (*Vigna Mungo* L.) is one of the important pulse crops grown in India. The crop is resistant to adverse climatic conditions and it improves the soil fertility by fixing atmospheric nitrogen in the soil. Reports indicated that blackgram produces nearly 22.10 kg of N ha^{-1}, which is estimated to be supplement of 59 thousand tonnes of urea annually (Jat *et al*., 2017). The pulse black gram plays an important role in Indian diet, as it contains vegetable protein and acts as supplement to cereal based diet. It contains about 26% protein, which is approximately three times that of cereals, and other minerals and vitamins. In addition, it is used as nutritive fodder, especially for milch animals. Black gram is known to be grown on variety of soils ranging from sandy soils to heavy cotton soils. India is the world's largest producer and consumer of black gram. Nearly, 1.5 to 1.9 million tons of blackgram is produced annually from about 3.5 million hectares of area in India with an average productivity of 500 kg ha^{-1}.

Though pulses are grown widely in India, about 2-3 million tons of pulses are imported annually to meet the domestic consumption requirement. The factors attributed for low yields of pulses in India are non- availability of quality seeds of improved and short duration varieties, growing of pulses under marginal and sub marginal soils with low inputs, growing under rainfed conditions, moisture stress, poor pest and disease management practices, unscientific post harvest practices and storage conditions. There is a scope to improve the productivity of pulses by enhancing the soil fertility and its productivity through increasing soil organic carbon, soil moisture storage capacity and adopting integrated nutrient management practices. Natural farming is the new method introduced as a holistic alternative to the present chemical input based agriculture. There has been increasing interest in the use of panchagavya, beejamrutha, jeevamrutha and other liquid organic formulations during the recent years. There is need to compare the efficiency of natural liquid organics and the regular chemical fertilizers on growth of pulses. Hence the present investigation is taken up with the aim to study the effect of different foliar spray of organics on growth of blackgram.

Acharya N.G. Ranga Agricultural University, Guntur-522 034, Andhra Pradesh, India.

Corresponding Author: Y. Bhargavi, Acharya N.G. Ranga Agricultural University, Guntur-522 034, Andhra Pradesh, India. Email: bhargavisweety2306@gmail.com

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MATERIALS AND METHODS

The present field experiment was carried out at S.V. Agricultural College Dryland Farm, Tirupati Campus of Acharya N.G. Ranga Agricultural University during *kharif,* 2017 which is geographically situated at an altitude of 182.9 m above mean sea level on 79.5°E longitude and 13.5°N latitude. Soil samples were drawn at random from 0-30 cm depth from the experimental field. The composite soil samples were analyzed for different physico-chemical properties. The results of the physico-chemical analysis revealed that the soil was sandy clay loam in texture, slightly neutral in soil reaction (pH – 7.1), low in available nitrogen (175 kg ha^{-1}) and organic carbon (0.45%), medium in available phosphorus (28 kg ha^{-1}) and available potassium (204kg ha^{-1}). During the crop growth period, 738 mm of rainfall was received in 33 rainy days, as against the decennial average of 334.45 mm received in 20 rainy days for the corresponding period. Blackgram variety TBG-104 was taken for sowing and planted with 30cm x 10cm spacing. The experiment was laid out in randomized block design with 10 treatments and 3 replications.

T_1 : Recommended dose of fertilizers(RDF) (20-40-40 N, P_2O_5,K_2O).
T_2 : RDF + Seed soaked in water.
T_3 : Seed treatment with Beejamrutha.
T_4 : Soil application of Ghanajeevamruta @500 kg ha^{-1} as basal.
T_5 : Foliar sprays of Jeevamrutha @3% (Every 10 days).
T_6 : Foliar sprays of Panchagavya @3% (Every 10 days).
T_7 : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @500 kg ha^{-1} as basal.
T_8 : Soil application of Ghanajeevamruta @500 kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days).
T_9 : Soil application of Ghanajeevamruta @500 kg ha^{-1} as basal + Foliar sprays of Panchagavya @3% (Every 10 days).
T_{10} : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @500 kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days) + Foliar sprays of Panchagavya @3% (Every 10 days)

The crop was grown with the recommended dose of nutrients *i.e.* 20-40-40 N, P_2O_5 and K_2O kg ha^{-1} which were supplied through chemical fertilizers in T_1 and T_2 treatmental plots. The entire quantity of nitrogen, phosphorus and potassium were applied as basal at the time of sowing through urea, single super phosphate and muriate of potash, respectively. Growth attributes like emergence index, days to 50% flowering, root nodule number per plant, leaf area $plant^{-1}$ and dry matter were calculated.

Emergence index was calculated using the following formula:

$$\text{Emergence index} = \frac{n1}{dn1} + \frac{n2}{dn2} \cdots \cdots + \frac{nx}{dnx}$$

Where,

n_1 is the number of seeds emerged on day d (1^{st}), dn_1, is the number of days from the day of sowing, n_X is the number of seeds emerged at the final day, dn_X is the number of days to final count. Statistical analysis of the data was carried out using standard analysis of variance (Fisher and Yates,1938).

RESULTS AND DISCUSSION

Emergence index

Significant difference was recorded among different treatments with respect to emergence index (Table 1). Among the treatments, significantly higher emergence index was recorded in the treatments T_2 [RDF+ Seed soaked water (13.86)] followed by T_3 [Seed treated with beejamrutha (13.54)] and T_1 [RDF (13.41)]. Seed treatment with beejamrutha had significant influence on seed germination and hence on the emergence index.

Plant Height (cm)

The data pertains to plant height (cm) of blackgram as influenced by application of different organics was recorded from 15 DAS to harvest (Table 2). Among the treatments, RDF (T_1) and RDF along with seed treatment with water (T_2) recorded significantly higher plant height of 39.94cm and 39.68cm respectively at harvest compared to all other treatments.

Seed treatment with beejamrutha (T_3) and basal application of ghanajeevamruta@ 500kg ha^{-1} (T_4) recorded significantly lowest plant height compared to other treatments. The results revealed that application of inorganic fertilizers recorded higher plant height than natural organics application in blackgram. Similar results were reported by Thirumeninathan *et al*. (2017) in cowpea. However, foliar application of panchagavya was reported to be effective in increasing plant height compared to RDF and control in blackgram (Kumar *et al.* 2011; Sharavan Kumar *et al.* 2016).

Days to 50% flowering

The data regarding the effect of different liquid organics on days to 50% flowering was recorded and represented in the Table 1 indicated non-significant influenced. However, application of RDF alone or with seed priming with water (T_1 and T_2) has recorded earlier flowering compared to organic treatments followed by Seed treated with beejamrutha + Soil application of ghanajeevamruta@ 500kg ha^{-1} as basal + Foliar sprays of jeevamrutha @ 3% + Foliar sprays of panchagavya @3%. While, basal application of ghanajeevamruta (T_4) taken maximum number of days to 50% flowering due to slow initial establishment (low emergence index).

Total number of nodules (per plant)

A significant difference was recorded among the treatments with respect to number of root nodule recorded at 30 DAS (Table 1). Significantly highest number of root nodules were recorded when seed is treated with beejamrutha + ghanajeevamruta soil application as basal + Foliar sprays of jeevamrutha and panchagavya @ 3% (T_{10})(26.33) were supplied compared with RDF (20.67). Application of organics

individually also influenced the number of root nodules per plant due to the significant increase in microbial population with the addition of organic manures in combination with fermented liquid organic manures.

Leaf area (cm^2)

Green leaf area represents source strength of any crop plant. The data on the leaf area per plant was recorded at 10 days interval from 15 DAS to harvest was presented in the Table 3. It was found that application of RDF alone or with water soaked seed (T_1 and T_2) recorded significantly higher leaf area followed by (Seed treated with beejamrutha + Soil application of ghanajeevamruta as basal + Foliar sprays of jeevamrutha @ 3% + Foliar sprays of panchagavya @ 3% (T10) throughout the experiment. Whereas, significantly lower leaf area was recorded in the treatments Seed treated with beejamrutha (T_3) and Soil application of ghanajeevamruta @500 kg ha^{-1} as basal (T_4). Foliar spray of panchagavya @ 3% recorded higher leaf area than control in blackgram and greengram as reported by Britto and Girija (2006). Further,application of jeevamrutha @ 3% as foliar spray showed significantly higher leaf area (441.8 cm^2) than

Table 1: Effect of natural liquid organics on emergence index, days to 50% flowering and root nodule number of blackgram

Treatments	Emergence index	Days to 50% flowering	Root nodule number at 30DAS
T_1 : Recommended dose of fertilizers (RDF) (20-40-40 N,P_2O_5,K_2O)	13.41	33.67	20.67
T_2 : RDF + Seed soaked in water	13.86	33.67	20.33
T_3 : Seed treatment with Beejamrutha	13.54	33.33	23.33
T_4 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	13.04	34.00	26.33
T_5 : Foliar sprays of Jeevamrutha @3% (Every 10 days)	10.46	33.67	21.00
T_6 : Foliar sprays of Panchagavya @3% (Every 10 days)	10.52	33.67	21.33
T_7 : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	12.59	34.00	25.00
T_8 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days)	11.06	34.67	24.33
T_9 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Panchagavya @3% (Every 10 days)	11.15	34.67	25.33
T_{10} : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days) + Foliar sprays of Panchagavya @3% (Every 10 days)	12.85	33.67	26.33
Mean	12.25	33.83	23.40
SE m ±	0.19	0.39	0.40
CD (P=0.05)	0.56	NS	0.02

Table 2: Effect of natural liquid organics on plant height (cm) of blackgram.

Treatments	Plant height (cm)					
	15 DAS	25 DAS	35 DAS	45 DAS	55 DAS	At harvest
T_1 : Recommended dose of fertilizers (RDF) (20-40-40 N, P_2O_5,K_2O)	8.19	10.27	22.85	37.58	39.10	39.94
T_2 : RDF + Seed soaked in water	7.32	9.99	19.66	36.73	38.90	39.68
T_3 : Seed treatment with Beejamrutha	5.18	8.03	14.68	21.17	28.67	29.97
T_4 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	5.07	8.18	16.46	22.24	28.47	30.88
T_5 : Foliar sprays of Jeevamrutha @3% (Every 10 days)	6.24	9.23	17.87	29.74	34.72	35.41
T_6 : Foliar sprays of Panchagavya @3% (Every 10 days)	5.42	8.64	15.33	22.72	30.60	31.53
T_7 : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	5.51	8.81	15.03	25.77	30.30	32.30
T_8 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days)	6.17	9.10	17.66	29.14	34.37	35.68
T_9 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Panchagavya @3% (Every 10 days)	5.31	8.43	15.89	25.27	30.15	32.24
T_{10} : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days) + Foliar sprays of Panchagavya @3% (Every 10 days)	6.88	9.48	19.95	35.10	37.45	38.26
Mean	6.13	9.02	17.54	28.55	33.27	34.59
SE m ±	0.08	0.06	0.29	0.71	0.73	0.55
CD (P=0.05)	0.23	0.17	0.86	2.12	2.18	1.65

panchagavya (425.26 cm^2) at 55 DAS, as jeevamrutha contain more Zn, Fe, Cu, Mn and influenced direct or indirect effect on chlorophyll synthesis.

Root dry weight (g $plant^{-1}$)

Root dry weight /plant of blackgram was significantly influenced under different organic treatments recorded from 15 DAS to harvest at 10 days interval was depicted in Table 4. Significant higher root dry weight was noticed under RDF (T_1) and RDF along with seed treatment with water (T_2) followed by T10 (Seed treated with beejamrutha + Soil application of ghanajeevamruta as basal + Foliar sprays of jeevamrutha @ 3% + Foliar sprays of panchagavya @3%). Significantly lower root dry weight was recorded in the treatment T_3 (Seed treated with beejamrutha) and T_4 (Soil application of ghanajeevamruta as basal). Similar results were recorded in chickpea by Kiran *et al.* (2016). However integrated use of RDF along with organics has recorded best compared to other treatments was reported by Shariff and Sajjan (2017) in greengram.

Table 3: Effect of natural liquid organics on leaf area per plant (cm^2) of blackgram.

Treatments	Leaf area per plant (cm^2)					
	15 DAS	25 DAS	35 DAS	45 DAS	55 DAS	At harvest
T_1 : Recommended dose of fertilizers (RDF) (20-40-40 N, P_2O_5,K_2O)	18.86	84.85	277.27	435.21	480.90	453.61
T_2 : RDF + Seed soaked in water	21.91	98.94	328.96	470.11	511.91	477.75
T_3 : Seed treatment with Beejamrutha	14.45	59.20	224.84	396.14	408.35	381.51
T_4 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	13.36	54.06	200.74	354.28	391.19	363.31
T_5 : Foliar sprays of Jeevamrutha @3% (Every 10 days)	15.93	66.59	242.73	413.6	441.80	412.47
T_6 : Foliar sprays of Panchagavya @3% (Every 10 days)	14.88	59.14	216.55	386.73	425.26	392.85
T_7 : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	15.32	61.09	226.93	397.68	420.74	391.39
T_8 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days)	15.79	64.02	240.35	416.43	451.37	423.38
T_9 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Panchagavya @3% (Every 10 days)	11.66	44.88	192.89	368.12	404.21	376.75
T_{10} : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days) + Foliar sprays of Panchagavya @3% (Every 10 days)	17.21	70.52	250.67	430.81	450.41	419.29
Mean	15.94	66.33	240.19	406.91	438.61	409.23
SE m ±	0.312	1.951	8.245	5.997	8.624	7.158
CD (P=0.05)	0.933	5.843	24.686	17.957	25.823	21.432

Table 4: Effect of natural liquid organics on root dry weight (g $plant^{-1}$) of blackgram.

Treatments	Root dry weight (g $plant^{-1}$)					
	15 DAS	25 DAS	35 DAS	45 DAS	55 DAS	At harvest
T_1 : Recommended dose of fertilizers(RDF) (20-40-40 N, P_2O_5,K_2O)	0.03	0.19	0.36	1.54	1.65	1.76
T_2 : RDF + Seed soaked in water	0.04	0.2	0.4	1.61	1.74	1.71
T_3 : Seed treatment with Beejamrutha	0.03	0.12	0.2	1.17	1.24	1.35
T_4 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	0.02	0.13	0.19	1.16	1.21	1.31
T_5 : Foliar sprays of Jeevamrutha @3% (Every 10 days)	0.03	0.16	0.3	1.45	1.54	1.65
T_6 : Foliar sprays of Panchagavya @3% (Every 10 days)	0.03	0.14	0.26	1.23	1.34	1.36
T_7 : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	0.03	0.14	0.24	1.26	1.38	1.4
T_8 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days)	0.03	0.16	0.3	1.43	1.56	1.64
T_9 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Panchagavya @3% (Every 10 days)	0.02	0.14	0.23	1.2	1.27	1.39
T_{10} : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days) + Foliar sprays of Panchagavya @3% (Every 10 days)	0.03	0.17	0.34	1.49	1.61	1.72
Mean	0.03	0.16	0.28	1.35	1.45	1.53
SE m ±	0.003	0.004	0.011	0.014	0.011	0.017
CD (P=0.05)	0.008	0.011	0.033	0.042	0.032	0.05

Shoot dry weight (g plant-1)

The shoot dry weight/plant of blackgram under different organic treatments was significantly influenced from 15 DAS to harvest (Table 5). Shoot dry weight was significantly higher in treatments RDF along with seed treatment with water (2.86 g plant^{-1}) followed by RDF (2.82 g plant^{-1}) compared to all organics. Among the different organic applications seed treated with beejamrutha + Soil application of ghanajeevamruta as basal + Foliar sprays of jeevamrutha@ 3% + Foliar sprays of panchagavya @ 3% (T_{10}) recorded numerically higher shoot dry weight than T_8 (Soil application of ghanajeevamruta as basal + Foliar sprays of jeevamrutha @ 3% at 10 days interval) and T_5 (Foliar sprays of jeevamrutha @3% at 10 days interval) treatments. Shoot dry weight was significantly lower in the treatments T_3 (Seed treated with beejamrutha) and T_4 (Soil application of ghanajeevamruta@500kg ha^{-1} as basal). However integrated use of RDF along with organics has recorded significantly higher shoot dry weight compared to other treatments in greengram (Shariff and Sajjan, 2017).

Leaf dry weight (g plant^{-1})

Leaf dry weight per plant was increased from sowing to 55 DAS and decreased thereafter due to senescence and loss of leaf area (Table 6). Among the treatments RDF + Seed soaked in water (5.17 g plant^{-1}) and RDF (5.37 g plant^{-1}) recorded significantly higher leaf dry weight at 55 DAS compared to all other treatments. Seed treatment with beejamrutha (T_3) and basal application of ghanajeevamruta (T_4) recorded significantly lower leaf dry weight compared to other treatments. The results revealed that application of inorganic fertilizers recorded higher leaf dry weight than natural liquid organic application to blackgram crop as inorganics contain higher nitrogen and hence exhibit higher chlorophyll activity in plants. Similar results were reported by Kiran *et al.* (2016) in chickpea. Shariff and Sajjan (2017) reported that integrated use of RDF along with organics reported to be best compared to other treatments in greengram.

Pod dry weight (g plant^{-1})

Pod dry weight of blackgram as influenced by application of liquid organics was recorded at 10 days interval from 45 DAS to harvest and presented in Table 7. Among the treatments RDF along with seed priming with water (4.82 g plant^{-1}) and RDF (4.67 g plant^{-1}) recorded significantly higher pod dry weight at at harvest compared to all other treatments. Seed treatment with beejamrutha (T_3) and basal application of ghanajeevamruta (T_4) recorded lower pod dry weight compared to other treatments. The results revealed that application of inorganic fertilizers recorded higher pod dry weight than natural liquid organic application to blackgram crop as inorganics supply essential nutrients rapidly in the available form which helped in early establishment and higher growth. Similar results were reported by Kiran *et al.* (2016) in chickpea. Shariff and Sajjan (2017) reported that integrated use of RDF along with organics was best compared to other treatments in greengram.

Total dry weight (g plant^{-1})

Data pertaining to the effect of liquid organics on total dry weight was measured from 15 DAS to harvest at 10 days interval. Total dry weight was significantly influenced throughout the crop growth by different treatments (Table 8). RDF (T_1) and RDF along with seed treatment with water (T_2) recorded significantly higher total dry weight of 14.36 g plant^{-1} and 14.68 g plant^{-1} respectively at harvest compared

Table 5: Effect of natural liquid organics on shoot dry weight (g plant^{-1}) of blackgram.

Treatments	Shoot dry weight (g plant^{-1})					
	15 DAS	25DAS	35DAS	45DAS	55DAS	At harvest
T_1 : Recommended dose of fertilizers (RDF) (20-40-40 N, P_2O_5,K_2O)	0.08	0.31	2.33	2.62	2.72	2.82
T_2 : RDF + Seed soaked in water	0.08	0.32	2.54	2.7	2.81	2.86
T_3 : Seed treatment with Beejamrutha	0.06	0.16	1.72	1.93	2.01	2.07
T_4 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	0.06	0.2	1.83	2.04	2.12	2.39
T_5 : Foliar sprays of Jeevamrutha @3% (Every 10 days)	0.06	0.26	2.14	2.26	2.55	2.62
T_6 : Foliar sprays of Panchagavya @3% (Every 10 days)	0.04	0.21	1.98	2.14	2.31	2.39
T_7 : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	0.05	0.19	1.99	2.12	2.33	2.41
T_8 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days)	0.07	0.24	2.16	2.31	2.5	2.63
T_9 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Panchagavya @3% (Every 10 days)	0.06	0.2	1.95	2.11	2.35	2.53
T_{10} : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days) + Foliar sprays of Panchagavya @3% (Every 10 days)	0.07	0.28	2.25	2.43	2.57	2.65
Mean	0.06	0.24	2.09	2.26	2.43	2.54
SE m ±	0.002	0.005	0.034	0.044	0.050	0.042
CD (P=0.05)	0.007	0.016	0.102	0.133	0.150	0.126

to all other treatments. Seed treatment with beejamrutha (T_3) and basal application of ghanajeevamruta (T_4) recorded significantly lower total dry weight compared to other treatments. All other treatments recorded moderate plant dry weight values. Among the organics jeevamrutha alone or jeevamrutha combined organics have recorded significantly higher plant dry weight compared to other organics. This promotory effect of jeevamrutha could be due to the presence of higher Zn, Fe, Cu and Mn in jeevamrutha (TNAU portal) compared to other two liquid organics used. The results revealed that application of inorganic fertilizers recorded higher total drymatter accumulation than all the organics used in this study, due to higher NPK content and quick release of nutrients for plant growth. However, Shariff and Sajjan (2017) reported that integrated use of organics and inorganics recorded higher drymatter accumulation compared to inorganics alone in green gram.

Table 6: Effect of natural liquid organics on leaf dry weight (g plant^{-1}) of blackgram.

Treatments	Leaf dry weight (g plant^{-1})					
	15DAS	25DAS	35DAS	45DAS	55DAS	At harvest
T_1 : Recommended dose of fertilizers (RDF) (20-40-40 N, P_2O_5,K_2O)	0.08	0.64	2.65	4.76	5.17	5.11
T_2 : RDF + Seed soaked in water	0.11	0.76	2.9	5.06	5.37	5.29
T_3 : Seed treatment with Beejamrutha	0.05	0.45	1.87	3.8	3.95	3.73
T_4 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	0.06	0.48	1.96	3.84	4.02	3.78
T_5 : Foliar sprays of Jeevamrutha @3% (Every 10 days)	0.07	0.55	2.46	4.51	4.93	4.88
T_6 : Foliar sprays of Panchagavya @3% (Every 10 days)	0.06	0.53	2.12	4.00	4.26	4.10
T_7 : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	0.06	0.54	2.17	4.04	4.32	4.21
T_8 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days)	0.07	0.55	2.37	4.54	4.83	4.78
T_9 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Panchagavya @3% (Every 10 days)	0.06	0.52	2.08	3.94	4.16	3.96
T_{10} : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days) + Foliar sprays of Panchagavya @3% (Every 10 days)	0.08	0.58	2.55	4.66	4.98	4.86
Mean	0.07	0.56	2.31	4.32	4.60	4.47
SE m ±	0.005	0.019	0.085	0.085	0.077	0.054
CD (P=0.05)	0.015	0.057	0.254	0.254	0.23	0.161

Table 7: Effect of natural liquid organics on pod dry weight (g plant^{-1}) of blackgram

Treatments	Pod dry weight (g plant^{-1})		
	45 DAS	55 DAS	At harvest
T_1 : Recommended dose of fertilizers(RDF) (20-40-40 N, P_2O_5,K_2O)	2.08	3.74	4.67
T_2 : RDF + Seed soaked in water	1.82	3.45	4.82
T_3 : Seed treatment with Beejamrutha	1.16	2.36	3.14
T_4 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	1.16	2.4	3.38
T_5 : Foliar sprays of Jeevamrutha @3% (Every 10 days)	1.52	2.95	4.36
T_6 : Foliar sprays of Panchagavya @3% (Every 10 days)	1.18	2.65	3.55
T_7 : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	1.31	2.67	3.92
T_8 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days)	1.54	2.98	4.34
T_9 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Panchagavya @3% (Every 10 days)	1.18	2.47	3.72
T_{10} : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days) + Foliar sprays of Panchagavya @3% (Every 10 days)	1.74	3.35	4.72
Mean	1.47	2.90	4.06
SE m ±	0.04	0.03	0.05
CD (P=0.05)	0.13	0.09	0.14

Table 8: Effect of natural liquid organics on total dry weight (g plant^{-1}) of blackgram.

Treatments	Total dry weight (g plant^{-1})					
	15 DAS	25 DAS	35 DAS	45 DAS	55 DAS	At harvest
T_1 : Recommended dose of fertilizers(RDF) (20-40-40 N, P_2O_5,K_2O)	0.19	1.14	5.34	11	13.28	14.36
T_2 : RDF + Seed soaked in water	0.24	1.28	5.84	11.18	13.37	14.68
T_3 : Seed treatment with Beejamrutha	0.14	0.72	3.79	8.06	9.56	10.28
T_4 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	0.14	0.8	3.99	8.19	9.75	10.86
T_5 : Foliar sprays of Jeevamrutha @3% (Every 10 days)	0.16	0.97	4.9	9.73	11.97	13.51
T_6 : Foliar sprays of Panchagavya @3% (Every 10 days)	0.13	0.88	4.36	8.55	10.56	11.41
T_7 : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal	0.14	0.87	4.4	8.74	10.7	11.94
T_8 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days)	0.17	0.95	4.83	9.82	11.86	13.38
T_9 : Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Panchagavya @3% (Every 10 days)	0.14	0.86	4.26	8.42	10.25	11.6
T_{10} : Seed treatment with Beejamrutha + Soil application of Ghanajeevamruta @ 500kg ha^{-1} as basal + Foliar sprays of Jeevamrutha @3% (Every 10 days) + Foliar sprays of Panchagavya @3% (Every 10 days)	0.18	1.03	5.14	10.33	12.52	13.95
Mean	0.16	0.95	4.68	9.40	11.38	12.60
SE m ±	0.007	0.022	0.103	0.121	0.118	0.09
CD (P=0.05)	0.020	0.066	0.307	0.361	0.354	0.27

CONCLUSION

Recommended dose of fertilizer (20+40+40 kg N+P_2O_5 +K_2O/ ha) alone or with water soaked seeds recorded significantly highergrowth and yield attributescompare to natural organic treatments . Among natural organics treatment T_{10} (Seed treated with beejamrutha + Soil application of ghanajeevamruta@ 500kg ha^{-1} as basal + Foliar sprays of jeevamrutha @ 3% (Every 10 days) + Foliar sprays of panchagavya @ 3% (Every 10 days)) forbid to be superior over other organic treatments. Jeevamruta foliar spray has recorded higher plant height and dry matter accumulation (35.41 cm and 13.51 g plant^{-1}) compared to panchagavya foliar spray (31.53 cm and 11.41 g plant^{-1}) due to the presence of higher amount of nitrogen, micronutrients like Fe, Zn, Mn compared to panchagavya (TNAU portal). Beejamrutha seed treatment revealed to have influence on germination and hence on the emergence index (13.54) of blackgram. Therefore, it may be suggested that the integrated use of organics and fertilizers will result in producing higher yields besides improving the nutrient status of the soil.

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