

Effect of Various Cow-based Solution on Growth and Quality Parameters on Summer Groundnut (*Arachis Hypogaea* L.)

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Abstract—The present study was undertaken during summer season 2019 at Junagadh (Gujarat) to study the effect of various cow-based solution on growth and quality parameters for organic cultivation of summer groundnut (*Arachis hypogaea* L.). The experiment results revealed that next to 100% RDF, application of Panchagavya as foliar spray @ 3% at 30 and 45 DAS + 5 t ha⁻¹ FYM and FYM 5 t ha⁻¹ + Bio-fertilizers (Rhizobium + PSB + KSB) were found superior in respect of the growth parameters along with quality parameters. It is concluded that higher production obtained from summer groundnut under organic farming can be secured by application of Panchagavya as foliar spray @ 3% at 30 and 45 DAS + FYM 5 t ha⁻¹ along with FYM 10 t ha⁻¹ + Bio-fertilizers (Rhizobium + PSB + KSB) which also maintain physico-chemical properties of calcareous soil under South Saurashtra Agro climatic conditions.

Keywords: Panchagavya, Jeevamrut, Seaweed extract, Banana pseudo stem sap.

Introduction

Organic farming is getting more popular these days, which accentuates shift from high volume production system to high value production system. Indiscriminate use of agro-chemicals during the last 5-6 decades has adversely affected the soil fertility, crop productivity, produce quality and particularly the environment. Organic farming in recent years is gaining impetus due to realization of inherent advantages as it confers in sustaining crop production and also in maintaining dynamic soil nutrient status and safe environment (Lokanath and Parameshwarappa, 2006).

There is an urgent need to increase food production globally under shrinking land resources. Recently the Government of Gujarat declared “Gujarat Organic Farming Policy-2015” to support scientifically evolved organic farming practices for sustainable farming system along with the trustworthy marketing and supply chain of the produce with aim to promote technically sound, economically viable, environmentally non-degrading, and Socially acceptable use of natural resources in favour of organic agriculture.

The policy seeks to actualize the area and crop potential for organic farming, sustaining soil fertility, conserving bio-resources, strengthening rural economy, promoting value addition, accelerating the growth of agro-business and securing a fair standard of living for the farmers and agricultural workers and their families. For effective implementation of the policy, there is an urgent need to develop a composite package of practices for major crops of the region. National Centre for Organic Farming and National Horticulture Mission included such cow-based bio-enhancers in package of practices for organic cultivation of different crops. In India, organic farming was well developed during the past such as ‘Vedas’ which has specified use of ‘Panchgavya’ in agriculture. In Sanskrit, Panchgavya means the blend of five products obtained from cow namely dung, urine, milk, curd and ghee. Presence of naturally occurring, beneficial, effective microorganisms (EMO’s) in Panchgavya predominantly and lactic acid bacteria, yeast, actinomycetes photosynthetic bacteria and certain fungi besides beneficial and proven fertilizers such as Acetobacter, Azospirillum and Phosphobacterium were detected which have the beneficial effect especially in improving soil quality, growth and yield of crops (Selvaraj et al., 2007). Jeevamrut is acidic (pH 4.92) in nature. They are good source of macro and micro nutrients. N-2.38%, P-0.173%, K-0.280, Mg (ppm)- 46, Cu (ppm)- 51. Jeevamrut contain many vitamins, essential amino acid, growth promoting substances like indole acetic acid (IAA), gibberellins acid (GA) and beneficial microorganism. (Palekar, 2006).

Banana pseudo stem sap and seaweed extract have been recommended by agricultural universities. These products can be incorporated in organic farming module. Number of cow-based bio-enhancers like ‘Bijamrut’, ‘Jeevamrut’, ‘Panchagavya’, ‘Amrutpani’, ‘Sanjivak’ etc. have been developed in different organic farming systems by innovative organic growers or associations and NGOs. But very meagre

scientific information is available regarding such formulations. Considering these points in view, the present experiment is proposed to test the efficacy of some cow-based bio-enhancers and botanicals for organic cultivation of summer groundnut.

Materials and method

A field experiment was conducted at Organic Farming Research Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat) in summer season of 2016. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction with pH 8.19 and EC 0.34 ds/m and organic carbon 0.59%. The soil was low in available nitrogen (257.00 kg ha⁻¹), medium in available 30 and 45 DAS (T₃), *Panchagavya* as foliar spray @ 3% at 30 and 45 DAS + FYM phosphorus (29.63 kg ha⁻¹), potash (254.60 kg ha⁻¹). The experiment comprising of 12 treatments viz., Control (T₁), 100% RDF (T₂), *Panchagavya* as foliar spray @ 3% at 5 t ha⁻¹ (T₄), *Jeevamrut* @ 500 lit ha⁻¹ with irrigation at sowing, 30 and 45 DAS (T₅), *Jeevamrut* @ 500 lit ha⁻¹ with irrigation at sowing, 30 and 45 DAS + FYM 5 t ha⁻¹ (T₆), Banana sap as foliar spray @ 1% at 30 and 45 DAS (T₇), Banana sap as foliar spray @ 1% at 30 and 45 DAS + FYM 5 t ha⁻¹ (T₈), Seaweed extract as foliar spray @ 3.5% at 30 and 45 DAS (T₉), Seaweed extract as foliar spray @ 3.5% at 30 and 45 DAS + 5 t ha⁻¹ (T₁₀), FYM 5 t ha⁻¹ + Biofertilizers (*Rhizobium* + PSB + KSB) (T₁₁) and FYM 10 t ha⁻¹ (T₁₂) was laid out in randomized block design with three replications. The gross and net plot size were 5.0x3.0 m² and 4.0x1.8 m², respectively. The groundnut variety "TG-37A" was sown at 30x10 cm² using seed rate of 120 kg ha⁻¹. The cow-based formulations were prepared on farm as per the procedure given by National Centre for Organic Farming, Ghaziabad (NCOF, 2006).

Panchagavya

Mixing of fresh cow dung (7 kg), cow-ghee (1.0 kg), fresh cow urine (10 lit), cow milk (3 lit), cow curd (2 lit), jaggery (3.0 kg) and tender coconut water (3 lit). On the first day, 7 kg cow dung was thoroughly mixed with 1 kg cow ghee and kept for 72 hours followed by addition of 10 lit cow urine and 10 lit water. The mixture was stirred twice a day and allowed to ferment for 15 days. On the 19th day, 3 lit cow milk, 2 lit cow curd, 3 kg jaggery, 2 kg banana and 3 lit tender coconut water are added in the mixture and allowed to ferment for 7 days while stirring twice a day. The stock solution of *Panchagavya* is ready for use after a period of 25 days.

Jeevamrut

Take 100 lit water in barrel and add 10 kg cow dung +10 lit cow urine. Mix well with the help of a wooden stick, add 2 kg old jaggery and 2 kg pulse flour (gram, pigeon pea, greengram, cowpea or blackgram) and handful soil from rhizosphere area of banyan tree. Mix this solution well with a

wooden stick. Keep the solution aside for fermentation for two to seven days. Shake the solution regularly three times a day.

Banana pseudostem sap

Banana pseudostem sap was obtained from Soil and Water Management Unit, Navsari Agricultural University, Navsari (Gujarat).

Seaweed extract

Seaweed extract was obtained from Fisheries Research Station, Junagadh Agricultural University, Okha (Devbhumi Dwarka).

Biofertilizers

Rhizobium, PSB and KSB were obtained from the Department of Plant Pathology, College of Agriculture, Junagadh Agricultural University, Junagadh. KSB was obtained from Navsari Agricultural University, Navsari. Foliar spraying was done using knapsack sprayer with spray volume of 500 lit ha⁻¹. A recommended dose of FYM @ 5 t ha⁻¹ was applied uniformly in all the treatments before sowing of the crop. The initially prepared and filtered solution of *Panchgavya* was sprayed on the crop foliage as per treatments. Similarly, *Jeevamrut* was applied on the soil 500 lit ha⁻¹ as per treatments. The experiment was conducted on fixed site. The crop was raised as per organic standards in organically converted plot. Pest and disease protection measures were taken using organic or bio-pesticides.

Results and discussion

Data presented in Table: 1 showed that growth, yield and quality attributes viz., plant height, number of nodules per plant, dry weight of root nodules per plant, pod yield, haulm yield, oil and protein content significantly influenced by different treatments.

Significantly highest plant height at 45, 60 DAS and at harvest was observed with *Panchagavya* as foliar spray @ 3% at 30 and 45 DAS + FYM 5 t ha⁻¹ (37.47 cm), which remained statistically at par with application of FYM 5 t ha⁻¹ + Biofertilizers (*Rhizobium* + PSM+ KSB) (T₁₁), 100% RDF (T₂), Banana sap as foliar spray @ 1% at 30 and 45 DAS + FYM 5 t ha⁻¹ (T₈), *Jeevamrut* @ 500 lit ha⁻¹ with irrigation at sowing, 30 and 45 DAS + FYM 5 t ha⁻¹ (T₆), FYM 10 t ha⁻¹ (T₁₂), *Jeevamrut* @ 500 lit/ha with irrigation at sowing, 30 and 45 DAS (T₅). Whereas, the minimum plant height (30.00 cm) was recorded under control (T₁).

Panchagavya is the fermented organic manure which contains effective microorganisms (EMO) and methylotrophs profile bacteria (MPB) also. This helps in production of phytohormones like auxins and gibberellins. Similar findings have been reported by Panchal *et al.* (2017) and Chongre *et al.* (2019).

Significantly highest number of nodules per plant and dry weight of root nodules per plant at 45 and 60 DAS recorded under application of *Jeevamrut* @ 500 lit ha⁻¹ with irrigation at sowing, 30 and 45 DAS + FYM 5 t ha⁻¹ (T₆). It was statistically at par with 100% RDF (T₂), FYM 5 t ha⁻¹ + Bio-fertilizers (Rhizobium + PSM + KSB) (T₁₁), Banana sap as foliar spray @ 1% at 30 and 45 DAS + FYM 5 t ha⁻¹ (T₈), Seaweed extract as foliar spray @ 3.5% at 30 and 45 DAS + FYM 5 t ha⁻¹ (T₁₀). While, control (T₁) has significantly recorded lowest number of root nodules per plant at 45 and 60 DAS (41.05, 69.33 respectively) and dry weight of root nodules per plant at 45 and 60 DAS (50.04, 67.87 mg plant⁻¹)

The increase in the number of root nodule per plant and dry weight of root nodules per plant might be due to the better availability of nutrients. The IAA and GA present in *Jeevamrut* when applied as soil application created stimuli in the plant system and increased the production of growth regulators in cell system and ultimately stimulated growth and development. Suresh (2011), Safiullah *et al.* (2018)..

Significantly oil and protein content increased with application of *Panchagavya* as foliar spray @ 3% at 30 and 45 DAS + FYM 5 t ha⁻¹ (T₄), it was statistically at par with 100% RDF (T₂), FYM 5 t ha⁻¹ + Bio-fertilizers (Rhizobium + PSM+ KSB) (T₁₁), *Jeevamrut*@ 500 lit ha⁻¹ with irrigation at sowing, 30 and 45 DAS + FYM 5 t ha⁻¹ (T₆). Significantly, lowest oil (43.73%) and protein (15.48%) content was observed under the treatment control (T₁).

Conclusion

Based on one year field experimentation, it can be concluded that, higher production could be obtain with application of *Panchagavya*as foliar spray @ 3% at 30 and 45 DAS + FYM

5 t ha⁻¹ (T₄) or FYM 5 t ha⁻¹ + Bio-fertilizers (*Rhizobium* + PSB + KSB) (T₁₁) in summer groundnut (*Cv. TG-37A*) under medium black calcareous clayey soil of South Saurashtra Agro-climatic Zone.

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Table 1: Effect of different treatments on growth, yield and quality parameters

Treatments	Plant height (cm)			Number of nodules/plant		Dry weight of root nodules per plant (mg plant ⁻¹)		Oil content (%)	Protein content (%)
	45 DAS	60 DAS	at harvest	45 DAS	60 DAS	45 DAS	60 DAS		
	T ₁	4.58	14.80	30.00	41.05	69.33	50.04		
T ₂	7.67	20.37	36.27	50.51	82.96	65.73	91.14	48.53	21.63
T ₃	5.85	17.48	33.05	44.26	73.15	53.04	76.70	45.23	18.12
T ₄	7.09	21.32	37.47	45.00	80.79	64.66	87.37	49.20	22.18
T ₅	5.92	17.56	33.50	43.52	72.56	52.13	77.50	45.20	18.12
T ₆	7.14	19.68	35.82	50.88	83.22	66.55	94.23	46.33	20.90
T ₇	5.15	17.21	32.42	43.06	72.07	51.56	72.60	45.18	17.33
T ₈	6.98	20.14	35.95	47.44	80.28	60.17	82.30	47.53	18.93

T ₉	4.81	16.34	31.90	42.86	69.96	50.36	70.64	44.30	17.47
T ₁₀	6.48	18.29	34.45	47.03	78.27	59.11	80.97	44.67	19.60
T ₁₁	7.34	20.37	35.95	50.47	81.93	64.94	89.91	48.33	21.90
T ₁₂	7.40	19.60	33.80	45.70	73.93	64.00	83.99	46.00	20.19
S.Em.±	0.24	0.76	1.38	1.67	3.04	2.69	3.90	1.19	0.68
C.D.	0.73	2.23	4.06	4.90	8.92	7.90	11.45	3.51	2.00

Control (T₁), 100% RDF (T₂), *Panchagavya* as foliar spray @ 3% at 30 and 45 DAS (T₃), *Panchagavya* as foliar spray @ 3% at 30 and 45 DAS + FYM 5 t ha⁻¹ (T₄), *Jeevamrut* @ 500 lit ha⁻¹ with irrigation at sowing, 30 and 45 DAS (T₅), *Jeevamrut* @ 500 lit ha⁻¹ with irrigation at sowing, 30 and 45 DAS + FYM 5 t ha⁻¹ (T₆), Banana sap as foliar spray @ 1% at 30 and 45 DAS (T₇), Banana sap as foliar spray @ 1% at 30 and 45 DAS + FYM 5 t ha⁻¹ (T₈), Seaweed extract as foliar spray @ 3.5% at 30 and 45 DAS (T₉), Seaweed extract as foliar spray @ 3.5% at 30 and 45 DAS + 5 t ha⁻¹ (T₁₀), FYM 5 t ha⁻¹ + Biofertilizers (*Rhizobium*+ PSB + KSB) (T₁₁) and FYM 10 t ha⁻¹ (T₁₂)