

## REGULAR ARTICLE

# Growth and development of blackgram (*Vigna mungo*) under foliar application of Panchagavya as organic source of nutrient

R. Suresh Kumar, P. Ganesh, K. Tharmaraj and P.Saranraj

Department of Microbiology, Faculty of Science, Annamalai University, Annamalai Nagar, Chidambaram – 608002

**KEYWORDS**

Organic farming, Panchagavya, NPK and Blackgram

**CORRESPONDENCE**

R. Suresh Kumar, Department of Microbiology, Faculty of Science, Annamalai University, Annamalai Nagar, Chidambaram – 608002

E-mail: rsureshmb@yahoo.co.in

**EDITOR**

Seran Dinakar

CB Volume 2, Year 2011, Pages 09-11

**ABSTRACT**

The present study was aimed to improve the growth and development of Blackgram (*Vigna mungo*) under foliar application of panchagavya as organic nutrient. A pot culture experiment was conducted at the Experimental farm during March-May 2010 season to evaluate the efficacy of Panchagavya foliar spray and NPK on the physiological growth and yield of Blackgram (*Vigna mungo*) cv. ADT-3. The results of the experiment revealed that foliar application of Panchagavya recorded significant improvement in chlorophyll content, N content of root nodules, plant height, number of branches per plant, leaf area index (LAI) and dry matter production when compared with NPK and control. Yield attributes such as number of pods per plant, number of seeds per pod, test weight and grain yield were also recorded significantly higher under foliar application of Panchagavya over NPK and control. Three percent Panchagavya foliar spray given at 15<sup>th</sup>, 25<sup>th</sup>, 35<sup>th</sup> and 45<sup>th</sup> days of interval period recorded significantly higher growth and yield of Blackgram than NPK and untreated control.

**Introduction**

Organic farming in recent years is gaining impetus due to realization of inherent advantages it confers in sustaining crop production and also in maintaining dynamic soil nutrient status and safe environment (Lokanath and Parameshwarappa, 2006). Farmyard manure, compost, vermicompost, green manuring, agro-wastes and plant wastes from sources imply both for sustainability of soil organic carbon (Tolanur and Badanur, 2003) and supply of plant nutrients in traditional organic farming. In the existing technology of organic farming where FYM and compost are used as sources of nutrient supply, productivity of soil depletes during the transitory period (until fertility, structure and microbial activity of soil have been restored) leading to low yield levels in initial years of cultivation (Natarajan, 2002). Besides, in the light textured soils of arid and semi-arid regions bulky organic materials remain in undecomposed state for years due to inherent deficiency of soil organic carbon and microbial biomass responsible for decomposition of these materials. Hence it is imperative to evolve an alternative technology of organic farming that provides reasonable yields while restoring the fertility of soil during transitory period. The use of fermented, liquid organic fertilizers, effective microorganisms (EM) as foliar fertilizers have been introduced to modern agriculture in recent years to produce food with good quality and safety (Galindo *et al.*, 2007). Use of fermented curd, rich in beneficial microorganisms, is also practiced elsewhere both to augment plant growth and suppress pest loads on crop plants. The benefits of EM in increasing crop yields, improving crop quality and protecting plant from pests and disease have been demonstrated for a wide range of crops and soil conditions. The use of fermented cow dung, urine, milk fat, curd and milk with the name of Panchagavya is getting adaptive popularity in Indian agriculture largely through the efforts of small groups of farmers. Role of foliar applied Panchagavya in production of many plantation crops had been

well documented in India (Selvaraj, 2003). The present investigation was hypothesized to examine the effect of foliar application of 3 per cent Panchagavya on different physiological parameters, yield and yield attributes of blackgram (*Vigna mungo* L.).

**Materials and Methods**

An experiment on the lines of organic farming was conducted at Experimental farm, Department of Microbiology, Annamalai University by pot culture method during March-May 2010 season. The soil of the experimental pots was sandy in texture and mixture of black and red soil. The experiment was laid out in factorial Randomized Block Design (RBD) with 3 replications. It comprises 3 treatments. The sources of foliar application were applied at 4 stages of intervals, 15<sup>th</sup>, 25<sup>th</sup>, 35<sup>th</sup> and 45<sup>th</sup> day after sowing (DAS). Panchagavya solution was prepared by thorough mixing of fresh cow dung (7 Kg), cow ghee (butter oil, 1 Kg), fresh cow urine (10 l), cow milk (3 l), cow milk curd (2 l), jaggery (unrefined sugar from sugarcane juice, 3 Kg) and ripped banana (2 Kg) in a open plastic container. On the first day, 7 Kg cow dung was mixed with 1 Kg cow ghee and kept for 72 hours followed by addition of 10 l cow urine and 10 l water. The mixture was stirred twice in a day and allowed to ferment for 15 days. On the 18<sup>th</sup> day, 3 Kg cow milk, 2 Kg cow curd, 3 Kg jaggery and 2 Kg banana were added in the mixture and allowed to ferment for further seven days while stirring twice a day. The Panchagavya was ready for use after a period of 25 days (Natarajan, 1999 and Somasundaram *et al.*, 2004).

The experimental pots were prepared and Blackgram seeds were buried in the soil at a depth of 3 cm with enough space in two adjacent rows. The seeds were treated with 3 per cent Panchagavya solution and 0.1 % Mercuric chloride for their respective treatment before a pre-sowing of seeds. The growth components of plants were recorded at periodic intervals *viz.*, 20<sup>th</sup>, 40<sup>th</sup> and 60<sup>th</sup> DAS. Three plants per treatment were

uprooted manually for growth analysis. Each sample was separated into its component plant parts- leaves, stem, branches, pods and root nodules were also detached manually from the roots of each sample.

### Physiological Growth

Plant height, number of branches per plant, LAI, dry matter production from all the treatments were recorded after 20<sup>th</sup>, 40<sup>th</sup> and 60<sup>th</sup> DAS. The LAI was calculated by using the following formula given by Puttaswamy *et al.*, (1976). Dry weights of plant parts were obtained after drying at 65 ± 5°C for 72 hrs to determine dry matter production.

$$\text{LAI} = L \times W \times N \times K$$

Where,

L= length of the leaf in cm.

W= maximum width of the leaf in cm.

N= number of leaves per plant

K= constant (0.75 for cereal crops).

### Yield of Plants

Number of pods per plant, number of seeds per pod, grain yield and test weight from each treatment was recorded immediately after the harvest. The mean test weight of 100 grains per treatment was recorded at 14 per cent moisture content and expressed in grams.

### Estimation of Chlorophyll content by UV-VIS Spectrophotometer

Chlorophyll a, b and total chlorophyll content in the fresh leaves was determined at each treatment using the method advocated by Arnon (1949).

### Isolation of Root Nodule Bacteria – *Rhizobium* From Root Nodules

The well matured, large sized, healthy nodules were detached carefully and used for the *Rhizobium* isolation by using Yeast Extract Mannitol Agar (YEMA) medium.

### Estimation of N content of Root Nodules

The nitrogen content of the root nodules was estimated by Microkjeldhal method of diacid extraction  $\text{H}_2\text{SO}_4$ :  $\text{HClO}_4$  in the ratio of 5:2 (Humphries, 1956).

### Statistical Analysis

The data obtained were analyzed by one-way ANOVA followed by Dunnett t-test by using SPSS software as suggested by Gomez *et al.*, (1984). The critical difference (CD) was worked out at a five per cent probability level for significant results.

## Results and Discussion

### Physiological Growth

Foliar application of 3 percent Panchagavya recorded significantly the highest values of these growth parameters at all the observed stage of plant growth when compared with control. Recommended dose of fertilizer, NPK recorded the increased growth parameters but the value is slightly lower than foliar applied Panchagavya.

The Panchagavya treatment recorded the maximum plant height, number of branches per plant, LAI, dry matter production when compared with NPK and control at all the observed stage of plant growth (Table. 1). The Pooled data were obtained at final stage of plant growth, 42.6 cm, 10 Nos, 2.54, 5.1 g respectively. Plant height and growth characters of Blackgram were improved due to foliar spray of Panchagavya. The LAI is also related to the supply and availability of N to plants which is supplied by the source of foliar applied Panchagavya. It might have contained microbial metabolites in appreciable amount that

help in maintaining the opening of stomata for longer period both in optimum and adverse conditions during the crop growth which led to increased LAI providing stronger source for sink (Xu *et al.*, 2000).

Improved nutrition may enable greater leaf area production that results in greater interception of light thereby increasing dry matter production (Kumawat, 2009). The significant improvement in the accumulation of dry matter in plant and its distribution in different plant parts in the study was attributed to increased supply of plant nutrients, specific weight of leaf, chlorophyll synthesis, nitrogen metabolism, root nodules and phytohormones with the application of Panchagavya.

### Yield and Yield Attributes of Plants

The application of Panchagavya significantly increased pods/plant, number of seeds per pod, grain yield and test weight by 20, 7, 4.2 Kg, 3.9 g respectively over NPK and control (Table. 2). The results were obtained for the NPK treated plants were slightly lesser than Panchagavya treated plants. The significant improvement in dry matter accumulation, chlorophyll content and nitrogen content described above may be ascribed to higher yield and yield attributes with Panchagavya. Selvaraj (2003) also observed 36 % increased yield of French bean with application of vermicompost + Panchagavya. Natarajan (2002) reported increased yield of crop plants with Panchagavya application due to enhancement in the biological efficiency of crop plants.

### Estimation of Chlorophyll Pigment

The chlorophyll a, b and total content of fresh leaves were detected by UV-vis spectrophotometer after 60 DAS (Table. 3). The Panchagavya treated plant showed the amount of chlorophyll a, b and total was 2.2, 0.9 and 3.2 mg/wt. respectively followed by NPK and control. The increased chlorophyll content in the study might be associated with the supply of essential nutrients to the plants. Since chlorophyll synthesis in the plants is directly related to the availability of the physiologically active Fe, N, P and S micronutrients in plants available form. Hence the availability of these nutrients to plants helps in the formation of chlorophyll in the leaves. Increased chlorophyll 'a', 'b' and carotenoids content in green leaves with foliar application of organic solution has also been observed by Tejada and Gonzalez (2003) in rice.

### Isolation of *Rhizobium* From Root Nodules

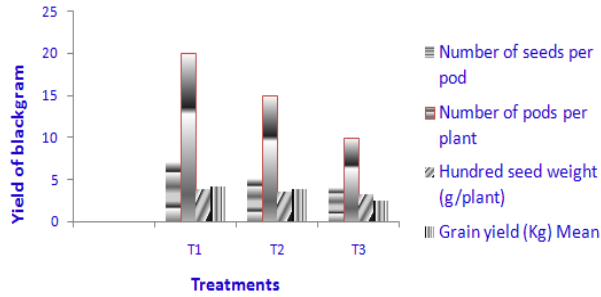
The isolates formed white translucent mucoid colonies on congo red YEMA. The isolates were gram negative rod, non spore forming, motile, containing poly β- hydroxyl butyrate granules. Colonies are circular, semi-translucent, raised mucilaginous, usually 2 to 4 mm in diameter within 3-5 days on YEMA medium. These isolates confirmed that the isolates belonged to *Rhizobium*.

### N content of Root Nodules

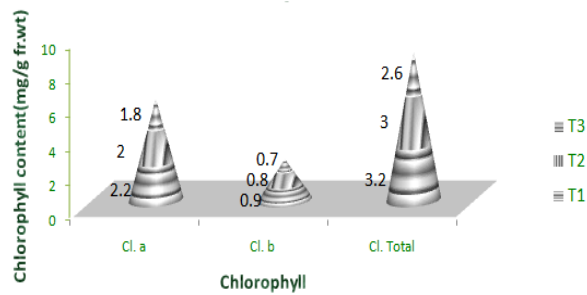
The isolates screened for efficiency based on N content and a value of 5.50 percent was present in the nodule. Panchagavya foliar application increased N content from 1.5 to 3.5 fold in groundnut as reported by Kumawat (2009). The economic evaluation done in the present investigation showed that the organic source of nutrients, Panchagavya not only recorded the increased growth and yield under each component crop but also comparatively lowered cost of cultivation in Panchagavya and net return.

## Conclusion

From this study, it is inferred that application of 3 percent Panchagavya foliar spray increase physiological growth, LAI, dry matter production, chlorophyll content, N content, yield, yield attributes and economics of Blackgram. Therefore, it can be recommended as an alternate source of nutrients for organic cultivation of Blackgram.



**Fig.1. Effect of foliar applied Panchagavya on yield and yield attributes of blackgram (Pooled data)**



**Fig.2. Effect of Panchagavya on chlorophyll content of fresh leaves of blackgram by uv-vis spectrophotometer (Pooled data)**

## References

- Arnon DI 1949. Copper enzyme in isolated chloroplast. Polyphenol oxidase in *Beta vulgaris*. *Plant Physiology* 24: 1-15.
- Galindo A, Jeronimo C, Spaans E and Weil M 2007. An introduction to modern agriculture. *Tierra Tropical* 3(1): 91-96.
- Gomez KA and Gomez AA 1984. Statistical procedure for Agriculture Research (II Ed.) John Wiley and Sons, Newyork. pp. 680.
- Humpries EC 1956. Mineral components and ash analysis. In: modern method of plant analysis, springer-verlag, Berlin., 1:468-502.
- Kumawat RN, Mahajan SS and Mertia RS. 2009. Growth and development of Groundnut (*Arachis hypogaea*) under foliar application of Panchagavya and leaf extracts of endemic plants. *Indian Journal of Agronomy* 54(3): 324-331.
- Lokanath HM and Parameshwarappa KG 2006. Effect of organics on the productivity of Spanish bunch groundnut under rainfed farming situations. In: *Proceedings of 18<sup>th</sup> World Congress of Soil Science*. pp. 62-63. Philadelphia, Pennsylvania, USA.
- Natarajan K 2002. Panchagavya: a manual. pp. 13-27. Other India Press, Mapusa, Goa, India.
- Puttaswamy SS, Timmagowda S and Krishnamurthy K 1976. Determination of leaf area in pulses. *Curr. Res.*, 5(3): pp. 47.
- Selvaraj N 2003. Report on Organic Farming at Horticulture Research Station, Tamil Nadu Agricultural University, Ooty, 2003-04. pp. 2-5.
- Tejada M and Gonzalez JL 2003. Effects of foliar application of a byproduct of the two-step olive oil mill process on rice yield. *European Journal of Agronomy* 2(1): 31-40.
- Tolanur SI and Badanur UP 2003. Effect of integrated use of organic manures, green manure and fertilizer nitrogen on sustaining productivity of rabi sorghum-chickpea system and fertility of a vertisol. *The journal of the Indian society of Soil Science* 51: 41-44.
- Xu HL, Wang XJ and Wang JH 2000. Effect of microbial inoculation on stomatal response of maize leaves. *Journal of Crop.Prod.*3(1):235-243.