# Evaluation of Indigenous Organic Foliar Nutrition Panchagavya in Maize Based Cropping System

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## Abstract
Field experiments were conducted to evaluate the organic sources of nutrients and Panchagavya spray on the biochemical changes and yield of maize-sunflower-green gram cropping system. The experiment consisted of nine treatments comprising six treatments of organic sources of nutrients with and without Panchagavya (blend of five products obtained from cow) foliar spray; two treatments were recommended dose of fertilizers (RDF) with and without recommended foliar spray (RFS) and one control (neither manured nor fertilizer applied). The study revealed that increased soluble protein content and NRase activity of maize, sunflower and green gram with BGS and it was comparable to RDF, RFS, RDF and biogas slurry (BGS) treatments. Higher yield of maize and sunflower were recorded under BGS with Panchagavya. Grain yield of green gram was higher under recommended fertilizer treatments but it was comparable to BGS with Panchagavya. Among all the organic sources tried, BGS+Panchagavya spray proved to be a better source than others.

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## Introduction
Heavy use of chemicals in agriculture has weakened the ecological base in addition to degrading the soil, water resources and quality of the food. At this juncture, a keen awareness has sprung on the adoption of organic farming as a remedy to cure the ills of modern chemical agriculture. It is very much essential to develop a strong workable and compatible package of nutrient management through organic resources for various crop based on scientific facts, local conditions and economic viability. Crops can produce essential amino acids, fatty acids and other nutrient that are more important for human health when the soil is healthy with sufficient organic carbon to sustain the microbial population. Scientific studies are limited under irrigated upland conditions to report about the biochemical changes that can be achieved through pure organic sources of nutrient supply in comparison with inorganic sources. Hence the present study was taken up to evaluate the effect of organic sources of nutrients and Panchagavya spray on the biochemical changes and yield of crops in the maize based cropping system.

## Materials and Methods
Field experiments were conducted from June 2001 to April 2003 at Tamil Nadu Agricultural University, Coimbatore to evaluate the organic sources of nutrients and Panchagavya spray on the biochemical changes and yield of crops in the maize-sunflower-green gram cropping system. There were nine treatments *viz.*, $T_1$- Navathaniyam as intercrop in situ on 45 DAS (Days after sowing); $T_2$- $T_1$+ Panchagavya Spray; $T_3$-Bio-gas slurry from 3 milch animals (BGS); $T_4$ -$T_3$+ Panchagavya spray; $T_5$-*Sesbania aculenta* as intercrop incorporated in situ on 45 DAS; $T_6$-$T_5$+ Panchagavya spray; $T_7$-Recommended NPK fertilizers (RDF); $T_8$-$T_7$+ Recommended foliar spray (RDF+RFS); $T_9$-Control (Neither manures nor fertilizers). The treatments were fitted in a randomized block design replicated thrice. For all organic nutritional treatments the recommended dose of N alone was substituted through organic sources and no P and K were applied. Seed treatment and soil application of biofertilizers were done common to all the treatments except control. Navathaniyam (Mixture of nine crop seeds viz. Pearl millet, sesame, cowpea, pigeon pea, black gram, green gram, horse gram, chick pea and sword bean in equal proportions on weight basis) was sown @ 50 kg $ha^{-1}$ one day prior to sowing of main crop in such a way that it formed an intercrop in between the main crop rows. Panchagavya was prepared using the ingredients viz., biogas slurry/ cow dung (5kg), Cow's urine (3L), cow's milk (2L), cow's curd (2L), cow's clarified butter or ghee (1L), sugarcane juice (3L), tender coconut water (3 L) and ripe banana (12 Nos). All above items were added to a wide mouthed mud pot and kept open under shade. The contents were stirred twice a day for about 20 minutes, both in the morning and evening to facilitate aerobic microbial activity. After fifteen days of incubation, a three per cent spray solution was prepared from the Panchagavya stock solution. The spay solution (50 litres per ha) was sprayed on 15, 30, 45 and 60 DAS for maize and sunflower where as it was given on

15, 25, 40 and 50 DAS for green gram using hand operated sprayer with high pore size nozzle. Ethanol soluble protein content was determined by the procedure described by Lowry *et al.*, 1951 and expressed as mg $g^{-1}$ fresh weight. Nitrate reductase activity of young leaves was determined using the method of Nicholas *et al.*, 1976. The enzyme activity was expressed as µ moles $NO_2$ $h^{-1}$ $g^{-1}$ fresh weight.

## Results and Discussion

### *Biochemical components of crops*

Soluble protein which is the index of photosynthesis was found significantly higher in all crops studied under RDF + RFS and it was comparable with both BGS applied treatments during first year and BGS + *Panchagavya* in second year (Table 1). Higher soluble protein might be due to increased net photosynthesis facilitated by the increased leaf area. On the other hand, foliar spraying of NAA might have enhanced the leaf soluble protein in RDF + RFS as the same was evident from the findings of Kalarani (1991) in soybean. Higher leaf area coupled with timely availability of N under RDF along with 2 per cent DAP spray on leaves might have favoured more N absorption by roots and leaves of green gram plants and consequently more soluble protein content resulted in its leaves. Higher soluble protein content under BGS + *Panchagavya* and also RDF + RFS might have increased the RUBP (Ribulose-1,5-bisphosphate) carboxylase activity in carbon cycle.

Nitrate reductase (NRase), the important enzyme involved in the nitrogen assimilation process and the key of metabolic regulation in crops was markedly influenced by the sources of nutrients (Table 1) in both the years. In maize and sunflower, significantly higher NRase activity was observed under BGS + *Panchagavya*. In green gram RDF + RFS recorded the highest NRase activity but it was comparable with BGS + *Panchagavya*. Presence of growth promoting substances such as IAA and GA in *Panchagavya* coupled with fast N mineralization in the soil supplied with BGS + might have influenced more N uptake and hence more NRase activity. The maximum NRase activity in green gram under RDF + RFS might be due to 2 per cent DAP spray which could have favoured high enzyme level and higher N assimilation rate. Similar responses to 2 per cent DAP spray in summer soybean was noticed by Rana, 2000. Significantly lowest NRase activity and soluble protein content was observed under control which might be due to reduction in enzyme level and poor N assimilation.

### *Yield of crops*

***Maize:*** Biogas slurry + Panchagavya recorded the highest grain yield of 8.34 t $ha^{-1}$ during 2001 followed by RDF + RFS. But during the 2002, RDF+RFS recorded the highest grain yield followed by Biogas slurry + Panchagavya and

**Table 1:** Biochemical parameters of crops on 45 DAS as influenced by organic sources of nutrients in 2001 and 2002

| Treatments | Soluble protein content (mg $g^{-1}$) | | | | | | NRase activity (µ moles $NO_2$ $h^{-1}$ $g^{-1}$) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | | | 2002 | | | 2001 | | | 2002 | | |
| | Maize | Sunflower | Green gram | Maize | Sunflower | Green gram | Maize | Sunflower | Green gram | Maize | Sunflower | Green gram |
| $T_1$ | 13.84 | 13.72 | 14.52 | 12.01 | 13.14 | 13.42 | 802 | 987 | 422.7 | 805 | 1106 | 482.0 |
| $T_2$ | 13.61 | 14.80 | 15.53 | 13.11 | 14.15 | 14.38 | 823 | 1202 | 508.7 | 815 | 1204 | 557.7 |
| $T_3$ | 13.64 | 15.46 | 15.82 | 13.63 | 15.51 | 14.28 | 847 | 1421 | 481.3 | 832 | 1496 | 570.0 |
| $T_4$ | 15.20 | 15.93 | 16.94 | 14.12 | 16.15 | 15.11 | 892 | 1661 | 554.7 | 858 | 1552 | 591.0 |
| $T_5$ | 14.04 | 13.84 | 13.84 | 12.55 | 13.36 | 13.76 | 810 | 1231 | 445.0 | 803 | 1172 | 492.3 |
| $T_6$ | 14.41 | 15.66 | 16.36 | 13.29 | 14.52 | 14.56 | 837 | 1502 | 539.0 | 818 | 1301 | 514.3 |
| $T_7$ | 15.00 | 15.59 | 16.62 | 13.84 | 15.38 | 15.62 | 870 | 1541 | 556.3 | 833 | 1436 | 571.7 |
| $T_8$ | 15.22 | 15.97 | 16.79 | 14.26 | 16.10 | 15.90 | 884 | 1621 | 570.0 | 834 | 1532 | 610.0 |
| $T_9$ | 11.90 | 11.90 | 12.29 | 10.81 | 11.55 | 11.54 | 737 | 932 | 272.7 | 696 | 829 | 237.3 |
| SEd | 0.15 | 0.20 | 0.22 | 0.13 | 0.30 | 0.26 | 9.18 | 68.1 | 23.3 | 15.9 | 53.7 | 19.3 |
| CD (P=0.05) | 0.32 | 0.42 | 0.46 | 0.27 | 0.63 | 0.55 | 19.46 | 144.2 | 49.3 | 33.6 | 113.9 | 41.0 |

**Table 2:** Yield of crops as influenced by organic sources of nutrients in 2001 and 2002

| Treatments | Grain yield (kg ha $^{-1}$) | | | | | |
|---|---|---|---|---|---|---|
| | 2001 | | | 2002 | | |
| | Maize | Sunflower | Green gram | Maize | Sunflower | Green gram |
| $T_1$ | 6.59 | 1599 | 1088 | 5.60 | 1840 | 920.3 |
| $T_2$ | 7.46 | 2047 | 1223 | 5.92 | 2310 | 1027.0 |
| $T_3$ | 7.74 | 2724 | 1248 | 7.24 | 2910 | 1079.3 |
| $T_4$ | 8.34 | 3144 | 1528 | 8.05 | 3242 | 1233.3 |
| $T_5$ | 6.92 | 2163 | 870 | 6.12 | 1954 | 940.7 |
| $T_6$ | 7.24 | 2899 | 1291 | 6.50 | 2464 | 1064.0 |
| $T_7$ | 8.22 | 3012 | 1529 | 7.59 | 2787 | 1303.7 |
| $T_8$ | 8.24 | 3117 | 1614 | 8.19 | 3165 | 1372.3 |
| $T_9$ | 4.47 | 508 | 417 | 3.59 | 435 | 398.7 |
| SEd | 0.18 | 33.5 | 49.3 | 0.23 | 59.6 | 37.18 |
| CD (P=0.05) | 0.38 | 71.1 | 104.6 | 0.48 | 126.4 | 78.82 |

were comparable (Table 2). Better nutrient availability, uptake and the resultant increased growth and yield parameters as evidenced in the present study under BGS + Panchagavya treatments might have increased the yield of maize. Improvement in yield attributes and yield of maize treated with biogas slurry as reported by Rameshwar Singh and Totawat (2002) is concomitant to this finding.

***Sunflower:*** Biogas slurry + Panchagavya produced the highest yield of 3.14 and 3.24 t ha$^{-1}$ during 2001 and 2002 (Table 2) and it was followed by RDF + RFS and both were found superior to RDF + BGS treatments. The narrow C: N ratio and quick mineralization of BGS as compared to other organic sources of nutrients might have facilitated formation of rich nutrient pool contributing to higher grain yield.

***Green gram:*** Highest grain yield of 1614 and 1372 kg ha$^{-1}$ during I and II year was produced under RDF + RFS (Table 2) and it was comparable with RDF in both years and also with BGS + Panchagavya during first year. Since, the green gram was grown after high nutrient demanding maize, which is a heavy feeder of N and exhaustive sunflower, the better responses to direct application of nutrients was observed from the increased values of nutrient uptake. However, quick N mineralization by microbes in BGS and also supply of nutrients through Panchagavya could have met the requirement of green gram and hence appreciable grain yield was also observed under BGS + Panchagavya.

## Conclusion

Increased soluble protein content and NRase activity of maize, sunflower and green gram were estimated under BGS with Panchagavya spray and they were comparable to RDF to RFS, RDF and BGS treatments in both the years. Higher yield of maize and sunflower were recorded under BGS with Panchagavya. Grain yield of green gram was higher under recommended fertilizer treatments but it was comparable to BGS with Panchagavya.

## References

Kalarani MK 1991. Senescence regulation in soybean (*Glycine max* L.) Merril. M.Sc., (Agri) Thesis submitted to Tamil Nadu Agricultural University, Coimbatore.

Lowry DH, Rose Brough LA and Randall RJ 1951. Protein measurement with folin phenol reagent. J. Biol. Chem. 193: 265-275.

Nicholas JC, Harper JE and Hageman RH 1976. Nitrate reductase activity in soybean I. Effects of light and temperature. Plant Physiol. 58: 731-735.

Rana AS 2000. Effect of organic manures and foliar spray of nutrient and growth regulators on growth and yield on soybean (*Glycine max* L.) Merril. M.Sc., (Agri) Thesis submitted to Tamil Nadu Agricultural University, Coimbatore.

Singh R and Totawat KC 2002. Effect of integrated use of nitrogen on the performance of maize (*Zea mays*) on haplustalfs of sub-humid southern plains of Rajasthan. Indian J. Agric. Res. 36(2): 102-107.