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# Optimization of Organic Nutrient Management in Maize (Zea mays) inTawang district of Arunachal Pradesh

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## ABSTRACT

A field experiment was conducted during Kharif 2017 and 2018 at three villages Lemberdung, Khinmey and Changprong in Tawang district of Arunachal Pradesh to study the effect of combination of organic nutrient sources for maize production. The experiment consisted of eleven treatments, comprising different levels of compost manure equivalent (75, 100 and 125kg N/ha) with FYM @ 10 t/ha, *beejamrith* + *Jeevamrith*. The results indicated that, application of 100% N equivalent compost + FYM @ 10 t/ha +*beejamrith* +*jeevamrith* @ 500l/ha. recorded significantly higher grain yield (5.3 t/ha), cob length (14.5 cm) and plant height (225.5 cm), which was closely followed by application of 100% N equivalent compost +*beejamrith* + *jeevamrith* @ 500 l/ha and 125 % N equivalent compost +*beejamrith* + *jeevamrith* @ 500 l/ha. Soil chemical properties, *viz.,* soil pH, organic carbon and electric conductivity were not influenced by application of organic manures. However, an increasing trend was observed in the soil chemical properties selative to initial soil data. Application of 100% N equivalent compost + FYM @ 10 t/ha + *beejamrith* + *jeevamrith* recorded significantly higher available nitrogen, phosphorous and potassium content in the soil compared to the other treatment.

**Key Words***: Beejamrith***,** Compost, FYM,Grain yield, *Jeevamrith***,** Maize.

## INTRODUCTION

Maize is the second most important food crop of Arunachal Pradesh after rice. In Arunachal Pradesh it is grown over an area 48,800 ha with total production 78,500 mt and average yield is 16.08 q/ha. In Tawang district, it is cultivated over an area of 762 ha. With total production 1434 mt and the average yield is 18.82 q/ha. As maize demands nutrients continuously in large amounts and use of large quantity of chemically formulated fertilizers alone is not only feasible but also costly to the resource-poor farmers, as majority of the maize is grown by small and marginal farmers. Apart from this, use of chemical fertilizers has resulted in progressive rise in multi-nutrient deficiencies, nutrient imbalances, deterioration of soil health and productivity. Although the organic manure contains plant nutrients in small quantities compared to fertilizers, they influence in building up of organic matter, good soil aggregation, permeability of soil and related physical properties in addition to long-lasting supply of several macro and micronutrients, vital plant-promoting substance apart from increasing the density of microbes in the soil. This helps in maintenance and possible improvement of soil fertility and health for sustaining crop productivity. Keeping this in view, a field experiment was conducted to study the influence of organic manures on soil fertility and productivity of rain fed maize.

## MATERIALS AND METHODS

A field experiment was conducted during the rainy season of 2017 and 2018 in the three villages' Lemberdung, Khinmey and Changprong ofTawang district .The area falls under humid, subtropical climate. The daily temperature of the experimental site during the year varies widely between minimum

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$15^0$c and maximum $30^0$c with an average rainfall of 2,220.0 mm. The soil was sandy loam with pH was 7.0 ( neutral in reaction). The initial soil analysis indicated that it was low in organic carbon (0.32%), available nitrogen (225kg/ha), medium in phosphorous (18.2 kg/ha) and potassium (133kg/ha). The experiment consisted of eleven treatments and three replications. The treatments included were, $T_1$,75% N equivalent compost;$T_2$, 100% N equivalent compost; $T_3$,125% N equivalent compost ; $T_4$, 100% equivalent compost + FYM @ 10 t/ha; $T_5$, 75% N equivalent compost + *beejamrith*; $T_6$, 100% N equivalent compost + *beejamrith*; $T_7$, 125% N equivalent compost +*beejamrith* ; $T_8$, 75% N equivalent compost+*beejamrith*+*jeevamrith*@500l/ha; T9,100%N equivalent compost +*beejamrith*+ *jeevamrith* @ 500l/ha; $T_{10}$, 125% N equivalent compost+ *beejamrith* + *jeevamrith* @ 500l/ha;$T_{11}$, 100% N equivalent compost + FYM @ 10 t/ha +*beejamrith*+ *Jeevamrith* @ 500 l/ha. The recommended dose of nutrients is 120:60:40 kg NPK/ha. Maize variety HQPM 1 was sown in first fortnight of May 2017 and 2018 with a spacing of 60 cm x 30 cm. using a seed rate of 20 kg/ha. The seed were soaked with *beejamrith* over night and then dried under shade before sowing. The manures were applied in the form of compost. The liquid organic formulation *beejamrith* and *jeevamrith* were prepared as per the procedures given by Palekar (2006). *Beejamrith* was prepared by soaking 5 kg of local cow dung in 20 litres of water and 50 g lime in 1 litre water overnight .Next day morning squeeze the cow dung into the lime –soaked water and to this add 10 l local cow urine , stir thoroughly and add lime solution and mix well. *Jeevamrith* is prepared by mixing 10 kg local cow dung with 10 l cow-urine , add 2kg local jiggery, 2kg pulse flour and handful of garden soil and the volume is made up to 200 l . Keep the drum in shade covering with wet gunny bag and stir the mixture clockwise thrice a day and incubate. The nutrient content of FYM was 0.58% N, 0.32% P and 0.52% K, of compost was 1.13% N, 0.67% P and 1.13% K. The recommended dose of the FYM and compost were applied as basal dose 20 days before sowing. After 30 days of sowing *Jeevamrith* was sprayed @ 500 l/ha. Standard package of practices were adopted. Growth, yield parameters and yield were measured and estimated using standard procedures. The data collected from the experiment at different growth stage were subjected to statistical analysis.

**Table 1. Influence of organic manures on growth and yield of maize (pooled data of 2 years).**

| | Treatment | Plant Height (cm.) | No. of leaves | Cob Length (Cm.) | Grain Yield (t/ha.) |
|---|---|---|---|---|---|
| $T_1$ | 75% N equivalent compost | 177.2 | 8.87 | 11.42 | 2.90 |
| $T_2$ | 100% N equivalent compost | 189.3 | 10.13 | 13.25 | 3.77 |
| $T_3$ | 125% N equivalent compost | 178.3 | 10.00 | 12.39 | 3.93 |
| $T_4$ | 100% N equivalent compost +FYM@ 10 t/ha. | 193.0 | 10.93 | 13.12 | 4.34 |
| $T_5$ | 75% N equivalent compost+*beejamrith* | 183.9 | 10.13 | 13.32 | 4.03 |
| $T_6$ | 100% N equivalent compost+ *beejamrith* | 191.6 | 9.87 | 13.74 | 3.31 |
| $T_7$ | 125% N equivalentcompost+ *beejamrith* | 177.1 | 10.53 | 12.42 | 3.62 |
| $T_8$ | 75% N equivalent compost +*beejamrith*+*jeevamrith* @ 500 l/ha. | 191.1 | 10.00 | 14.07 | 4.13 |
| $T_9$ | 100% N equivalent compost+*beejamrith* +*jeevamrith* @ 500 l/ha. | 202.4 | 11.67 | 14.20 | 4.80 |
| $T_{10}$ | 125% N equivalent compost +*beejamrith*+*jeevamrith* @ 500l/ha. | 195.0 | 11.30 | 13.87 | 4.82 |
| $T_{11}$ | 100% N equivalent compost+ FYM@ 10t/ha. *beejamrith*+*jeevamrith* @ 500 l/ha. | 225.5 | 12.77 | 14.50 | 5.3 |

## RESULTS AND DISCUSSION

### Growth parameters

The growth parameters, plant height at harvesting and number of leaves/plant at 60 DAS of maize, varied significantly due to application of different organics. Among the difference sources of organics, application of 100% N equivalent compost recommended FYM+ *beejamrith+jeevamrith* recorded higher plant height and number of leaves (225 cm. and 12.77 respectively) compared to other treatment (Table 1). This was closely followed by 125% N equivalent compost +*beejamrith+Jeevamrith* and 100% N equivalent compost+*beejamrith+jeevamrith*. This increase in plant height and number of leaves may be owing to higher N availability throughout the crop-growth period owing to its slow release. Manjhi *et al* (2016) also reported similar increase in maize growth parameters with the application of organics.

### Yield parameters

The application of different sources of organic did not influence the yield -attributing parameters, viz test weight, number of rows/cob and number of grains/row significantly. However, the cob length was influenced significantly. The longer cob was observed in application of 100% N equivalent compost+ recommended FYM+*beejamrith+jeevamrith* (14.50cm) compared to the other treatments. This was closely followed by 125% N equivalent compost+*beejamrith+jeevamrith* and 100% N equivalent compost+*beejamrith+jeevamrith*. This increased cob length was mainly attributed to diversion of more photosynthesis to reproductive parts. Similar increase in maize yield parameters with the application of FYM was also reported by Dhiman (2014).

### Yield

The results indicated that, the grain yield of maize varied significantly among different levels and source of organic manures (Table 1). The grain yield was significantly higher with application 100% N equivalent compost+recommended FYM+*beejamrith* +Jeeva mrith(5.3 t/ha) compared to other source of organics. This was closely followed by 125% N equivalent compost +*beejamrith+jeevamrith* (4.82t/ha.) and 100% N

**Table 2. Influence of organic manures on economics of maize (pooled data of 2 years).**

| | Treatment | Gross return (Rs. /ha.) | Cost of cultivation (Rs. /ha.) | Net Return (Rs. /ha.) | B: C ratio |
|---|---|---|---|---|---|
| $T_1$ | 75% N equivalent compost | 58,000 | 48,000 | 10,000 | 1.2 |
| $T_2$ | 100% N equivalent compost | 75,400 | 48,400 | 27,000 | 1.5 |
| $T_3$ | 125% N equivalent compost | 78,600 | 53,200 | 25,400 | 1.4 |
| $T_4$ | 100% N equivalent compost +FYM@ 10 t/ha. | 86,800 | 62,100 | 24,700 | 1.3 |
| $T_5$ | 75% N equivalent compost+*beejamrith* | 80,600 | 42,100 | 38,500 | 1.9 |
| $T_6$ | 100% N equivalent compost+*beejamrith* | 66,200 | 49,200 | 17,000 | 1.3 |
| $T_7$ | 125% N equivalentcompost+ *beejamrith* | 72,400 | 57,100 | 15,300 | 1.2 |
| $T_8$ | 75% N equivalent compost+*beejamrith+jeevamrith* @ 500l/ha. | 82,600 | 40,200 | 42,400 | 2.0 |
| $T_9$ | 100% N equivalent compost+*beejamrith +jeevamrith* @ 500l/ha. | 96,000 | 42,200 | 53,800 | 2.2 |
| $T_{10}$ | 125% N equivalent compost+*beejamrith +jeevamrith* @ 500l/ha. | 96,400 | 58,100 | 38,300 | 1.6 |
| $T_{11}$ | 100% N equivalent compost+ FYM@ 10t/ ha.+*beejamrith+jeevamrith* @ 500l/ha. | 106,000 | 68,100 | 37,900 | 1.5 |

**Table 3. Influence of organic cultivation practices on soil chemical properties after the harvesting of second crop.**

| Treatment | | PH | EC (dS/m) | Organic carbon N | Soil-available Nutrient (kg/ha) | | | Nutrient uptake (Kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $P_2O_5$ | $K_2O$ | N | $P_2O_5$ | $K_2O$ | |
| **T1** | 75% N equivalent compost | 7.72 | 0.325 | 0.36 | 231.5 | 20.8 | 135.2 | 145.6 | 15.2 | 89.56 |
| **T2** | 100% N equivalent compost | 7.35 | 0.351 | 0.37 | 242.3 | 24.9 | 152.1 | 156.9 | 16.21 | 92.65 |
| **T3** | 125% N equivalent compost | 7.25 | 0.358 | 0.36 | 251.8 | 33.2 | 158.9 | 165.8 | 17.85 | 96.32 |
| **T4** | 100% N equivalent compost +FYM@ 10 t/ha. | 6.78 | 0.341 | 0.41 | 269.8 | 31.3 | 170.1 | 150.6 | 16.25 | 112.3 |
| **T5** | 75% N equivalent compost+*beejamrith* | 7.85 | 0.328 | 0.39 | 235.6 | 23.6 | 135.2 | 160.2 | 18.41 | 105.6 |
| **T6** | 100% N equivalent compost+ *beejamrith* | 7.62 | 0.341 | 0.38 | 251.2 | 28.2 | 153.6 | 168.9 | 18.96 | 110.5 |
| **T7** | 125% N equivalent compost+ *beejamrith* | 7.28 | 0.351 | 0.36 | 261.2 | 35.6 | 162.3 | 160.2 | 20.12 | 115.6 |
| **T8** | 75% N equivalent compost +*beejamrith*+*jeevamrith* @ 500l/ ha. | 7.00 | 0.335 | 0.37 | 245.6 | 25.6 | 142.5 | 175.6 | 20.15 | 118.9 |
| **T9** | 100% N equivalent compost +*beejamrith*+*jeevamrith* @ 500l/ ha. | 7.03 | 0.359 | 0.39 | 245.3 | 33.8 | 156.3 | 180.5 | 22.36 | 120.3 |
| **T10** | 125% N equivalent compost +*beejamrith*+*jeevamrith* @ 500l/ ha. | 7.52 | 0.361 | 0.41 | 265.4 | 35.7 | 168.5 | 185.6 | 23.62 | 125.6 |
| **T11** | 100% N equivalent compost+ FYM@ 10t/ha. + *beejamrith*+*jeevamrith* @ 500l/ ha. | 6.78 | 0.371 | 0.42 | 263.5 | 32.5 | 172.3 | 186.2 | 24.01 | 130.2 |

equivalent compost+*beejamrith*+*jeevamrith* (4.80t/ ha.) This was mainly owing to the fact that apart from source of nutrient, application of organic manures improved the physico-chemical properties of soil that resulted in better root system with increased absorption of moisture and nutrients from the deeper layers, which inturn enhanced the growth and yield attributing parameters of maize and finally grain yields. These results were in line with the findings of Sujatha *et al* (2008) and Choudhary and Suresh Kumar (2013). Praveen *et al* (2012) and Suresh Naik *et al* (2012).

## Economics

Among the treatments, application of 100% N equivalent compost+*beejamrith*+*jeevamrith* @ 500 l/ha was found superior in obtaining higher net returns (Rs. 53,800/ha) and benefit: cost ratio (2.2) as compared to other treatments. This was closely followed by application of 75% N equivalent compost+*beejamrith* +*jeevamrith* @ 500 l/ha. This increased net returns and B: C ratio was mainly owing to reduced cost of cultivation and increased grain yield. Though, the highest cost of cultivation was recorded in application of 100% N equivalent

compost + FYM @ 10 t/ha +*beejamrith*+*jeevamrith* @ 500 l/ha. (Rs 68,100/ha.), this treatment recorded the highest yield but economically not viable. These results are in line with Mohammad *et al* (2017).

**Soil physico-chemical properties**

The soil physico-chemical properties, viz.$P^H$, electrical conductivity and organic carbon were not influenced at the end of the second crop cycle. However, these parameters were enhanced greatly as compared to initial soil-test value. In the present investigation, there was a significant difference among the different sources of nutrient with respect to soil-available nutrients. Application of 125% N equivalent compost +*beejamrith*+*jeevamrith* registered significantly higher amount of soil available nutrients (265.4, 35.7 and 168.5kg N,$P_2O_5$ and $K_2O$/ha) and was at par with 100% N equivalent compost +recommended FYM+*beejamrith*+*jeevamrith* (263.5,32.5 and 172.3N, $P_2O_5$ and $K_2O$/ha respectively). This was owing to build up of more amount of organic carbon in the soil and which in turn enhanced the nutrient-supplying capacity of the soil because build up of more and more soil micro-organisms. The uptake of major nutrients were significantly higher in application of 100% N equivalent compost +FYM @10 t/ha+*beejamrith*+*jeevamrith* @ 500 l/ha (186.2:24.01:130.2kg N:P:K/ha) as compared to the other treatments. However, it was at par with 125% N equivalent compost+*beejamrith*+*jeevamrith* @ 500 l/ha (185.6: 23.62:125.6kg NPK/ha) and 100% N equivalent compost +*beejamrith*+*jeevamrith* @ 500 l/ha. These results were in line with earlier findings of Praveen *et al* (2012) and Choudhary and Suresh Kumar (2013)

## CONCLUSION

Application of 100% N equivalent compost+*beejamrith*+*jeevamrith* @ 500l/ha to maize proved economically superior and ecological viable in improving the maize grain yield coupled with improving soil physico-chemical properties.

## REFERENCES

Choudhary V K and Suresh Kumar (2013). Maize production, economics and soil productivity under different organic source of nutrients in Eastern Himalayan region, India. *Indian J Plant Prod 7* (2): 167-170.

Dhiman M (2014). Influence of integrated nutrient management on productivity, nutrient uptake and economics of maize-yellow sarson cropping system under rain fed mid hill condition. *Indian J Agron* **59** (2):436-442.

Manjhi RP, Mahapatra P, Shabnam S and Yadava MS ( 2016). Long term effect of nutrient management practices on performance of quality protein maize under maize (*Zea mays*)-wheat (*Triticum aestivam*), cropping sequence. *Indian J Agron* **61** (4): 436-442.

Mohammad H, Shiva D, Vyas AK, Pramesh V and Bipin K (2015). Integrated nutrient management in maize –wheat cropping system. *Indian J Agron* **60** (3): 352-359.

Palekar S (2006). Textbook on Shoonya Bandovaladanaisargika Krushi Swamy Anand. Agri. Prakashan, Benguluru, Karnataka.

Praveen M, Patil V, Kuligod B, Hebsur NS, Patiland NS and Kulkarni GN (2012). Effect of phosphate solubilising fungi and phosphorous levels on growth, yield and nutrient content in maize (*Zea mays*). *Karnataka J Agri Sci* **25** (1): 58-62.

Sujatha MG, Lingaraju B S, Palled YB and Ashalatha KV (2008). Importance of integrated management practices in maize under rain fed conditions. *Karnataka J Agri Sci* **21** (3): 334-338.

Suresh Naik KP, Narayana S, Mavarkar Basavaraj, Naik T, Krishnamurthy N and Sowmyalatha BS (2012). Effect of farm yard manure and bio digester liquid manure on growth and yield of maize (*Zea mays* L.) under rain fed condition. Crop Res **44** (3): 279-282.

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