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**P Srinivas**
Turmeric Research Station, Kammarpally, Nizamabd dist Sri Konda Laxman Telangana State Horticultural Univeristy, Siddipet dist, Telangana, India

**B Mahender**
Turmeric Research Station, Kammarpally, Nizamabd dist Sri Konda Laxman Telangana State Horticultural Univeristy, Siddipet dist, Telangana, India

**Corresponding Author:**
**P Srinivas**
Turmeric Research Station, Kammarpally, Nizamabd dist Sri Konda Laxman Telangana State Horticultural Univeristy, Siddipet dist, Telangana, India

# New method of organic production in ginger: A step towards sustainability and ecological balance

**P Srinivas and B Mahender**

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**Abstract**
The trial wa conducted at the turmeric research station, kammarpally for the continuous of two years (2019-2021) to assess the potential of organic methodology developed by Indian Institute of Spices Research. In recent years, organic agriculture has been gaining considerable importance. Many farmers today show interest all over the world in organic farming. Several of them have begun switching to this traditional method of cultivation as a means to produce safe foodstuffs and preserve the environment. A field experiment has been conducted to study the organic cultivation of ginger. In this trial a comparative study of organic cultivation over inorganic cultivation was undertaken with 3 varieties $V_1$- Nadia, $V_2$- Maran and $V_3$- Local type to study the effect of different organic manures package in ginger. Organic manures viz, PGPR Stain of GRB-35, FYM, neem cake, vermicompost, sulphate of potash, IISR- ginger booster used as organic source of nutrients formulated by Indian Institute of Spices Research, Kozhicode, Kerala for this trial. Maximum mean yield (20.72 t/ha) was observed from organic production with variety Maran and the maximum mean plant height (56.71cm), number of shoots (11.69), maximum mean height of shoot (23.84 cm), maximum mean leaf length (18.13 cm), leaf width (2.075 cm), leaf petiole length (3.04) recorded from the organic production module over traditional inorganic method of cultivation.

**Keywords:** Vermicompost, FYM, fresh rhizome yield, ginger booster, GRB-35 strain

## Introduction
Ginger (*Zingiber officinale* Rosc.) belongs to the family Zingiberaceae is a perennial herbaceous monocotyledon plant that is commercially cultivated as an annual crop for its rhizomes. It has been cultivated in the country since ancient times and is a significant commercial spice crop [1]. It is a high-value tropical rhizomatous spice crop grown in tropical and subtropical climates. Despite being grown in numerous countries, it thrives best in humid, tropical climates. Ginger has a long history that goes back more than 5000 years. It is a South East Asian native, but over the years, it has spread across several regions of the world, including Africa. The countries like UK, the USA, and Saudi Arabia import the majority of the harvest. Nigeria is the greatest amount of ginger growing country (56.23% of the world's total area), followed by Bangladesh, India, China, and Indonesia, which have approximately 23.6, 4.7, and 3.4 per cent of the total area under ginger, respectively Ginger is used for various kinds of purposes in India, including pickles, food additives, confections, and traditional remedies for stomach aches. It is a powerful antioxidant and has been used to treat all kinds of nausea, including those brought on by motion sickness, pregnancy, surgery, and nausea following chemotherapy [3]. Traditional and modern medications both employ ginger as a common raw ingredient [4]. This is due to the volatile oleoresin and volatile oil found in ginger [5]. Regarding the rising global demand for organic products, ginger producers that cultivate organically should expect to receive significant profits on their investments. Organic has gained more attention due to enhanced quality, better market demand, and environmental protection [6]. The concept of organic farming is not new to India but Indian Farmers traditionally follow the indigenous farming principles and practices for a sustainable farming and preservation of environment which are in tune with present day organic farming concepts. Heavy usage of chemical fertilizers harms the soil health and causes ecological imbalance. It is important to adopt the balanced use of organic manures and bio-fertilizers for the ecological balance and correct management of soil health. The use of organic

manures and bio-fertilizers improve soil macro and micro flora and these are eco friendly. Hence, this trial has been conducted to study the effect of IISR-organic methodology over inorganic method of ginger cultivation.

## Materials and Methods

The field trial has been carried out to study the effect of organic manures on growth and yield of ginger on vertisols at Turmeric research station, Kammarpally, Nizamabad district, Telangana during three consecutive years from 2017-18 to 2019-20. The initial soil status of the experiment was less alkaline pH (7.65), electric conductivity 0.15 dS $m^{-1}$, low organic carbon with medium available nitrogen (250 kg $ha^{-1}$), high available phosphorus (32.57 kg $ha^{-1}$) and high available potassium (332.7 kg $ha^{-1}$).

This experiment has been laid out in a randomized block design with three replications. The treatments comprised general recommended $T_1$-Organic package developed by IISR, $T_2$-State Agriculture University package. The seed has been sown in the month of June and harvested at 8 months crop stage in the month of February during the experimental years.

This experiment conducted with two treatments ($T_1$-Organic module developed by IISR; $T_2$- Recommended practices of SAU) with three varieties $V_1$- Nadia, $V_2$-Maran and $V_3$- Local type. All the treatments were replicated for three times. In this experiment growth, yield characters were recorded.

| Practice | $T_1$- Organic production developed by IISR | $T_2$- SAU recommendations |
|---|---|---|
| Pre sowing Rhizome treatment | Seed treatment<br>PGPR Stain of GRB-35 Capsule in 100 lit of water Seed rhizomes dipped in PGPR Solutions | Seed treatment Ridomyla @ 0.2% and Imidacloprid @0.05 % |
| Basal application | Organic manures to be applied before last ploughing FYM 25 to 30 t/ha, Neem cake 2t/ha | Top dressing FYM 20 t/ha, Neem cake 0.6 t/ha, SSP- 0.38 t/ha, MOP- 0.18 t/ha |
| Top dressing | Organic manures top dressing at 45th and 90th DAP, Vermicompost 2 t/ha, Ash 0.5 t/ha, Sulphate of Potash 50 kg/ha | Neem cake 0.6 t/ha (200 gram/plot) |
| Micro nutrients application | Foliar spray at 60th and 90th DAP IISR- ginger booster @ 5 gr/lit of water (3-4 kgs /ha) | Formula-6@ 20 kg/ha |
| Pest & Diseases control | Neem oil @ 0.5% B.M @ 0.1% | Chemicals recommended as per the pest and disease incidence |

## Results

### Vegetative characters

Significant differences were observed with plant height, number of shoots, height of shoot, leaf length characters and non significant differences were observed with the number of shoots, leaf width and leaf petiole length. The maximum mean plant height (56.71cm), number of shoots (11.69), maximum mean height of shoot (23.84 cm), maximum mean leaf length (18.13 cm), leaf width (2.075 cm), leaf petiole length (3.04) were recorded with organic module developed by IISR. Among the varieties the maximum mean plant height, number of shoots, maximum mean height of shoot, maximum mean leaf length, leaf width, leaf petiole length were observed in Maran variety. The increased vegetative growth in turmeric may be due to an increase in the activity of enzymes like chitinases and proteases that breaks down the organic-rich compounds. The availability of micro and macro nutrients were increased by the activities of micro flora and fauna with the application of vermicompost, FYM, organic and inorganic fertilizers (Kumar *et al*., 2018) [9]. These results are in conformity with Poapst *et al*. (1970) [13], who reported that earthworm castings from verimcompost shows hormonal activity and triggers plant nutrient uptake and plant metabolism resulted in increase of plant growth. The vegetative growth of the turmeric crop is influenced by the use of organic manures like FYM and Vermicompost revealed an increase in turmeric crop yield as well as enhancement of the physical, chemical and biological properties of soils (Dudhat *et al*., 1997) [6].

**Yield characters:** The maximum mean fresh rhizome yield per plot (7.77 kg/plot) and maximum mean fresh rhizome yield per hectare (20.72 t/ha) with organic module developed by IISR and among the varieties high fresh rhizome yield was observed with the Maran variety followed by Nadia with organic cultivation methodology.

These results are in line with several workers (Roy and Hore, 2011; Nanda *et al*., 2012) [15, 12]. Balashanmugam *et al*. (1989) [3] who enunciated that an increase in fresh turmeric rhizome yield from 25,550 kg ha-1 to 32,370 kg $ha^{-1}$ with an increased dose of FYM from 0 to 25 tonnes $ha^{-1}$ in $CO^{-1}$ turmeric crop. Sadanandan *et al*., (1998) [16] reported an increase of 37 per cent in the fresh rhizome yield of turmeric over control with 40 tonnes per hectare with the application of compost or cattle manure in the soil. Ginger farmers should treat ginger with organic manure so as to boost yield (Nmor, 2013) [11]. Organic cultivation of ginger has several advantages over the conventional one like protection of both the environment and human health, improved soil fertility, better water quality, prevention of soil erosion, generation of rural employment, etc. Organic manures in the forms of cow dung, poultry and pig manures have great tendency to increase growth characters and yield of ginger (Egbuchua and Enujeke, 2013) [5]. The findings reported by Kushwah *et al*. and Yadav *et al*. stated that It is possible due to combine application of NPK and Vermicompost may promoted the nitrogen content in the plant parts which pointers to the increased the chlorophyll content of leaf and ultimately increases the fresh weight of leaf. The field experiment has been conducted by Sharma *et al*. (2003) [17] at Jabalpur, Madhya Pradesh and reported that effect of organic manures and chemical fertilizers alone and in combination with each other on the yield of turmeric. They noticed that the application of chemical fertilizers reduced the fresh rhizome yield in turmeric in succeeding years while application of organic manures in the form of vermicompost or FYM increased the fresh rhizome yield of turmeric by 7 to 10 per cent over the preceding year. The maximum amount of organic carbon (0.80 %) was observed in the application of FYM which was on par with press mud cake and sugarcane trash. Organic farming improves soil physic-chemical properties and increases nutrient availability, water retention, and phosphate solubilization. In addition, organometal fertilizer enhances plant agro-physiological traits. It increases plant biomass and yield, improves nutrient assimilations, and improves plants physiological metabolism (Atere and Olayinka, 2012; Crusciol *et al*., 2020) [2, 4]. It has been observed that improvement in available nutrients with vermicompost or FYM application due

to mineralization of nutrients from organic manures in soil (Yaduvanshi, 2001) [24]. Sharma *et al*., (2009) [19] reported that increase in available nutrient content in soil with the use of organic manures. Sreenivas *et al*. (2000) [21] reported that the use of vermicompost, FYM and biofertilizers enhance the soil health, nutrient reaction and their availability. Sharma *et al*. (2004) [18] reported positive influence of vermicompost and organic manures on the availability of all essential plant nutrients during the crop period.

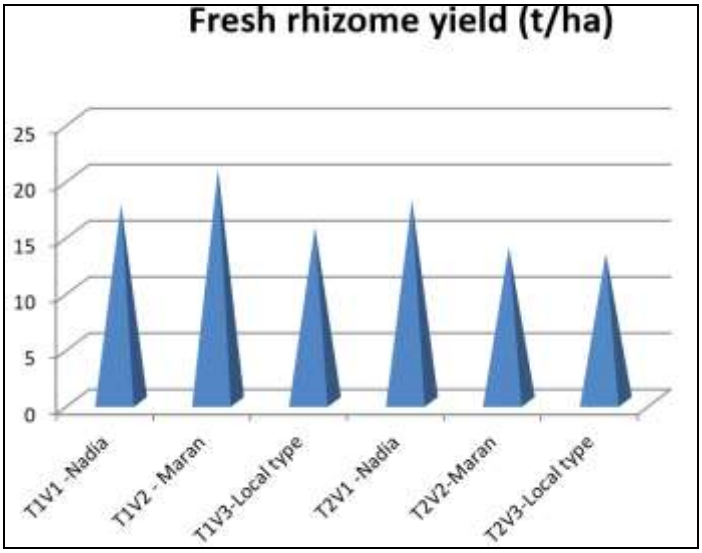


**Fig 1:** New method of organic production in ginger: A step towards sustainability and ecological balance

**Table 1:** New method of organic production in ginger: A step towards sustainability and ecological balance

| | Plant height (cm) | | | Number of shoots | | | Height of shoot (cm) | | | Leaf length (cm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019-20 | 2020-21 | Pooled mean | 2019-20 | 2020-21 | Pooled mean | 2019-20 | 2020-21 | Pooled mean | 2019-20 | 2020-21 | Pooled mean |
| $T_1V_1$ -Nadia | 44.7 | 55.3 | 50 | 10.32 | 11.32 | 10.82 | 20 | 19.25 | 19.625 | 17.25 | 14.3 | 15.775 |
| $T_1V_2$ - Maran | 52.12 | 61.3 | 56.71 | 11.23 | 12.15 | 11.69 | 25.575 | 22.12 | 23.84 | 17.56 | 18.7 | 18.13 |
| $T_1V_3$-Local type | 41.8 | 41.6 | 41.7 | 10.23 | 9.21 | 9.72 | 17.65 | 18.65 | 18.15 | 14.85 | 18.6 | 16.725 |
| $T_2V_1$ -Nadia | 49.9 | 39.3 | 44.6 | 10.24 | 9.68 | 9.96 | 17.62 | 17.69 | 17.655 | 18.25 | 17.25 | 17.75 |
| $T_2V_2$-Maran | 48.5 | 47.1 | 47.8 | 9.25 | 8.21 | 8.73 | 16.25 | 17.69 | 16.97 | 14.6 | 12.4 | 13.5 |
| $T_2V_3$-Local type | 45.35 | 45.5 | 45.425 | 8.62 | 9.8 | 9.21 | 15.36 | 14.65 | 15.005 | 15.45 | 15.325 | 15.3875 |
| SE(m) | 1.092 | 1.852 | 1.621 | 2.691 | 1.223 | 1.698 | 0.706 | 1.241 | 0.96 | 0.673 | 0.450 | 0.526 |
| CD (5%) | 3.320 | 5.626 | 4.256 | N.S. | N.S. | N.S | 2.149 | 3.775 | 2.85 | 2.048 | 1.369 | 1.955 |
| CV % | 4.760 | 7.644 | 5.621 | 41.24 | 23.836 | 38.52 | 7.381 | 5.061 | 6.365 | 7.500 | 5.756 | 6.214 |

**Table 2:** New method of organic production in ginger: A step towards sustainability and ecological balance

| | Leaf width (cm) | | | Leaf petiole length (cm) | | | Fresh rhizome yield kg/plot | | | Fresh rhizome yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019-20 | 2020-21 | Pooled mean | 2019-20 | 2020-21 | Pooled mean | 2019-20 | 2020-21 | Pooled mean | 2019-20 | 2020-21 | Pooled mean |
| $T_1V_1$ -Nadia | 1.15 | 2.02 | 1.585 | 1.65 | 3.725 | 2.68 | 7.85 | 6.64 | 6.61 | 17.54 | 17.70 | 17.62 |
| $T_1V_2$ - Maran | 2.05 | 2.1 | 2.075 | 2.36 | 3.725 | 3.04 | 6.58 | 7.69 | 7.77 | 20.93 | 20.50 | 20.72 |
| $T_1V_3$-Local type | 1.35 | 2.02 | 1.685 | 1.55 | 3.65 | 2.6 | 5.98 | 5.69 | 5.835 | 15.94 | 15.17 | 15.56 |
| $T_2V_1$ -Nadia | 1.4 | 2.05 | 1.725 | 1.35 | 3.75 | 2.55 | 6.85 | 6.63 | 6.74 | 18.26 | 17.68 | 17.97 |
| $T_2V_2$-Maran | 1.2 | 1.95 | 1.575 | 1.2 | 3.55 | 2.375 | 5.1 | 5.24 | 5.17 | 13.6 | 13.97 | 13.78 |
| $T_2V_3$-Local type | 1.3 | 1.97 | 1.635 | 1.2 | 3.7 | 2.45 | 4.8 | 5.12 | 4.96 | 12.8 | 13.65 | 13.22 |
| SE(m) | 0.113 | 0.064 | 0.956 | 0.185 | 0.118 | 0.152 | 0.154 | 0.327 | 0.254 | 0.514 | 0.816 | 0.625 |
| CD (5%) | N.S. | N.S. | N.S | N.S. | N.S. | N.S | 0.470 | 0.994 | 0.663 | 1.564 | 2.483 | 2.214 |
| CV % | 7.26 | 6.425 | 6.256 | 6.78 | 6.406 | 6.561 | 5.308 | 8.314 | 6.254 | 5.308 | 8.314 | 6.325 |

## Conclusion

The ginger cultivated in organic module developed by IISR proved to be better organic methodology for organic cultivation of ginger with Maran and Nadia varieties. The use of vermicompost, FYM and other inputs in this methodology improve soil condition, which is useful for higher net returns and maintenance of soil fertility in organic cultivation of turmeric.

## Future scope

Further this study may be taken up with different organic manures, bio-fungicides and bio-pesticides to analyze the impact of these different organic components to improve yield and curcumin content of turmeric.

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