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# Effect of FYM and inorganic fertilizer on growth and yield and *Rabi* grain amaranth (*Amaranthus hypochondriacus* L.)

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## ABSTRACT

**A field experiment was conducted during *Rabi* season of 2007-08 at College Farm, Navsari Agricultural University, Navsari to study Effect of farmyard manure and inorganic fertilizers on growth and yield of *Rabi* grain amaranth (*Amaranthus hypochondriacus* L.). The results revealed that seed yield, growth and yield attributes were significantly increased by the application of FYM @ 10 t ha$^{-1}$. Significantly the highest plant height (127.83 cm), number of leaves per plant (29.82) stem girth (3.65 cm), dry matter accumulation (82.51 g), number of spikelet per spike (52.89) and seed yield (1516.67 kg ha$^{-1}$) was recorded with the application of FYM @ 10 t ha$^{-1}$ over control. The per cent increase in yield by the application of FYM @ 10 t ha$^{-1}$ was to tune of 10.00 and 68.51 per cent over FYM @ 5 t ha$^{-1}$ and control treatment, respectively. The maximum plant height (134.31 cm) and number of leaves per plant were recorded significantly under the application of 100 per cent RDF whereas it was lowest under the control treatment. Treatment receiving 100 per cent RDF produced significantly highest stem girth (3.93 cm) and dry matter accumulation per plant being at par with 75 per cent RDF. Significantly higher numbers of lateral spikelets per spike were recorded in 100 per cent RDF ($F_2$) treatment being at par with 75 per cent RDF. Application of 100 per cent RDF produced significantly the highest seed yield (1612.00 kg ha$^{-1}$). This was 12.46 per cent higher over 75 per cent recommended dose of fertilizer.**

**Key words :** Grain amaranth, FYM and inorganic fertilizers

## INTRODUCTION

Grain amaranth (*Amaranthus hypochondriacus* L.) is a neglected psuedocereal crop belongs to family *Amaranthaceae*. In India, amaranth is commonly grown in Himachal Pradesh, Madhya Pradesh, Maharashtra and part of Gujarat. Amaranth is quick growing multipurpose crop with good potential for grain, vegetable and fodder. Among various agronomic factors known to augment crop yield, fertilizer management plays a vital role in increasing crop productivity, as the crop responds better to fertilizer application. Fertilizer is costly but important input of crop production. The use of farmyard manure along with inorganic fertilizer enhance productivity and improves the physico-chemical properties of soil. The increasing cost of fertilizers play a significant role in increasing cost of production of agricultural produce and there by reduction in the profit. Further, substitution of chemical fertilizers with organic manures, which is eco-friendly and the way out for saving of fertilizer. Organic manures are a good source of nutrients and contribute towards built up of organic matter in soil. Hence, balanced fertilizer use along with organic manure like FYM is considered as promising agro-technique to sustain yield and restore soil fertility.

## MATERIALS AND METHODS

The field experiment was conducted at the College Farm, N.M. College of Agriculture, Navsari Agricultural University, Navsari, during *Rabi s*eason of 2007-08. The soil of the experiment field was clayey in texture, low in available nitrogen (176 kg ha$^{-1}$), medium in available phosphorus (32 kg ha$^{-1}$) and fairly rich in available potassium (350 kg ha$^{-1}$) with 7.8 pH. Nine treatment combinations consisting of three levels of farmyard manure *viz*., control ($M_0$), FYM @ 5 t ha$^{-1}$ ($M_1$) and FYM @ 10 t ha$^{-1}$ ($M_2$) and three levels of inorganic fertilizer namely control ($F_0$), 75 per cent recommended dose of fertilizer ($F_1$) and 100 per cent recommended dose of fertilizer ($F_2$) were tried in a factorial randomized block design with four replications. The recommended fertilizer dose, *i.e.* 40:40:00 kg ha$^{-1}$ applied through inorganic fertilizer. The grain amaranth cv. GA-2 was sown on 5th November 2007 keeping 30 cm inter-row spacing and intra-row spacing of 10 cm was maintained by thinning operation. Recommended cultural practices were also adopted as per need of crop.

## RESULTS AND DISCUSSION

The results obtained from the present study as well as relevant discussion have been summarized under following heads:

### Growth attributes:

Application of FYM was found to have significant effect on most of the growth parameters. The mean plant height, number of leaves per plant, stem girth and dry matter accumulation recorded at various growth stages (Table 1) were significantly higher with the application of FYM @ 10 t ha$^{-1}$ and remained statistically at par with

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**Table 1 : Effect of different treatments on growth parameters at maturity, yield attributes and seed yield of *Rabi* grain amaranth**

| Treatments | Plant height (cm) | Number of leaves per plant | Stem girth (cm) | Dry matter accumulation (g plant$^{-1}$) | Number of spikelet per spike | Seed yield (kg ha$^{-1}$) |
|---|---|---|---|---|---|---|
| FYM levels ($M_0$) | | | | | | |
| $M_0$ = control | 111.60 | 25.78 | 3.16 | 79.44 | 48.37 | 900.00 |
| $M_1$ = 5 t FYM | 124.17 | 28.55 | 3.54 | 82.51 | 52.09 | 1378.67 |
| $M_2$ = 10 t FYM | 127.83 | 29.82 | 3.65 | 85.14 | 52.89 | 1516.67 |
| S.E. ± | 2.49 | 0.61 | 0.07 | 1.43 | 1.18 | 46.42 |
| C.D. (P=0.05) | 7.26 | 1.79 | 0.21 | 4.17 | 3.45 | 135.49 |
| Inorganic fertilizer levels (F) | | | | | | |
| $F_0$ = control | 104.83 | 23.88 | 2.8 | 78.2 | 46.60 | 750.00 |
| $F_1$ = 75 % RDF | 124.47 | 29.13 | 3.63 | 82.90 | 52.15 | 1433.33 |
| $F_2$ = 100 % RDF | 134.31 | 31.13 | 3.93 | 85.99 | 54.6 | 1612.00 |
| S.E. ± | 2.49 | 0.61 | 0.07 | 1.43 | 1.18 | 46.42 |
| C.D. (P=0.05) | 7.26 | 1.79 | 0.21 | 4.17 | 3.45 | 135.49 |

application of FYM @ 5 t ha$^{-1}$ over control. This might be attributed to multifarious role of FYM in supply of nutrients as well as improvement in physical, chemical and biological environment of soil. Finally, it was reflected in better growth of plant with FYM. The results are in conformity with the findings of Khanda and Mohapatra (2003) in grain amaranth.

Inorganic fertilizers also had significant effect on growth attributes. The plant height of grain amaranth was maximum with 100 per cent RDF treatment over control treatment. This was because of adequate supply of nitrogen and phosphorus. Nitrogen being a constituent of various essential metabolites including proteins and amino acids as well as structural constituent of the plant cell which might have influenced different physiological process such as cell division and elongation which ultimately resulted in higher plant height. Phosphorous is constituent of the cell nucleus and is essential for cell division and for development of meristem might have resulted in increased plant height. These results confirm the findings of Bhaskar *et al*. (1996) as well as Khanda and Mohapatra (2003).

Treatment receiving 100 per cent RDF recorded significantly the maximum number of leaves per plant. This might be ascribed to the increased availability of nutrients in the soil which enhanced the nutrient absorption by crop. Similar trend was reported by Barik and Khanda (1999). Treatment 100 per cent RDF produced significantly the highest dry matter accumulation per plant but it was at par with 75 per cent RDF. This was because nitrogen increased photosynthetic efficiency of leaves. Availability of more photosynthates resulted in higher number of leaves and stem girth. Whereas phosphorus improved root development and translocation of photosynthates reflected in better growth and ultimately in higher dry matter accumulation. The present results are in accordance with those of Bhaskar *et al*. (1996) for grain amaranth.

**Yield attributes and yield:**

Significantly maximum number of lateral spiklet per spike was recorded with the application of FYM @ 10 t ha$^{-1}$ but it was at par with application of FYM @ 5 t ha$^{-1}$. This could be ascribed to favourable effect of FYM on plant growth in terms of dry matter accumulation in plant and translocation of photosynthates towards plant parts resulted in higher number of branches per spike. These results are on the line with the findings of Khanda and Mohapatra (2003) in grain amaranth. The results revealed that FYM exerted remarkable effect on seed yield of grain amaranth. Significantly the highest seed yield (1516.67 kg ha$^{-1}$) was recorded with the application of FYM @ 10 t ha$^{-1}$ over control. This was because of favourable effect of FYM in improvement of growth attributes such as plant height, number of leaves per plant, dry matter accumulation and number of lateral spikelet per spike. The improvement in grain yield with the application of FYM may be owing to the beneficial effect of availability of nutrients leading to improvement in grain yield. Similar results were obtained by Khanda and Mohapatra (2003) and Patel *et al*. (2005) in grain amaranth.

Significantly higher numbers of lateral spikelets per spike were recorded in 100 per cent RDF treatment being at par with 75 per cent RDF. The increase in number of lateral spikelets per spike might have been due to the fact that nutrients being the major constituent of cell, helps in progressive initiation of tissue and expansion of cell,

which ultimately resulted in increased number of lateral spikelets per spike. The results are in close conformity with those of Khanda and Mohapatra (2003). Treatment receiving 100 per cent RDF produced significantly the highest seed yield (1612.00 kg $ha^{-1}$) over other treatments. The increase in seed yield might be due to remarkable improvement in the yield attributes such as number of spikelets per spike, better development of various growth parameters such as plant height, number of leaves per plant, stem girth, and dry matter accumulation resulted in higher seed yield. The results were supported by the findings of Khanda and Mohapatra (2003) as well as Patel *et al*. (2005).

**Interaction effect:**

Interaction effect of FYM and inorganic fertilizer levels on grain yield was found significant (Table 2). The

**Table 2 : Seed yield (kg $ha^{-1}$) of *Rabi* grain amaranth as influenced by interaction effect of FYM and inorganic fertilizers**

| Treatments | $F_0$= Control | $F_1$= 75% RDF | $F_2$= 100% RDF |
|---|---|---|---|
| $M_0$= Control | 600 | 750 | 900 |
| $M_1$= 5 t FYM | 950 | 1550 | 1800 |
| $M_2$= 10 t FYM | 1150 | 1836 | 1850 |
| S.E.± | | 80.40 | |
| C.D. (P=0.05) | | 234.68 | |

treatment combination of $M_2$ $F_2$ (FYM @ 10 t $ha^{-1}$ coupled with 100 per cent RDF) recorded significantly the higher seed yield which was at par with treatment combination $M_2$ $F_1$ (FYM @ 10 t $ha^{-1}$ coupled with 75 per cent RDF) and $M_1$ $F_2$ (FYM @ 5 t $ha^{-1}$ coupled with 100 per cent RDF). This might be due to adequate application of nutrients with 100 per cent RDF along with FYM 10 t $ha^{-1}$ which also provided nutrient to longer period of crop life which reflected in better growth and development of plant and ultimately resulted in increased seed yield. The results were supported by the findings of Khanda and Mohapatra (2003) as well as Patel *et al.* (2005) in grain amaranth.

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