

## ABSTRACT

A field experiment was conducted at the Horticulture Experimental Farm, College of Agriculture, Central Agricultural University, Imphal during the period of March to November in 2007 and 2008 to study the growth and productivity of ginger (*Zingiber officinale* Rosc.) as influenced by crop variety and biofertilizer. Two experiments were conducted – one on crop variety (Experiment no.1) and the other on biofertilizer (Experiment No. 2). Both the experiments were laid out in randomized block design in five and three replications respectively. The first experiment used four ginger varieties ('Manipur local', 'Bhaisey', 'Gorubathan' and 'Nadia') and the second experiment used three biofertilizers (Azotobacter, Azospirillum and Phosphotica) each at three levels (2.50, 3.75 and 5.00 kg ha<sup>-1</sup>) along with a common control. Altogether there were 28 treatment combinations in the second experiment. The experimental soil was clayey in texture, medium-high in fertility status, well-drained with gentle slope. The soil was acidic in reaction. The total rainfall received during the crop growing season of 2007 and 2008 were 1341.2 and 1137.3 mm respectively.

The ginger variety showed positive and significant effect on improving almost all the growth and yield attributes of ginger such as sprouting time, plant height, number of shoots per clump, number of leaves per clump, canopy spread, leaf area index, dry matter accumulation, crop growth rate, rhizome growth and rhizome bulking rate. Among the varieties 'Bhaisey' showed superiority in most of the cases, but were closely followed by 'Gorubathan'. Accordingly, the highest rhizome yield (20.46 t ha<sup>-1</sup>) was produced by 'Bhaisey' followed by 'Gorubathan' (19.13 t ha<sup>-1</sup>). 'Bhaisey' also produced good quality rhizome having high specific gravity (1.25 g cc<sup>-1</sup>) and dry matter content (20.4%) with moderate level of oleoresin (4.48%) and crude fiber content (6.75%).

Application of high level (5.0 kg ha<sup>-1</sup>) of Azotobacter and medium level (3.75 kg ha<sup>-1</sup>) of Azospirillum and Phosphotica showed superiority in increasing most of the growth and yield attributes of ginger like plant height, number of shoots per clump, number of leaves per clump, canopy spread, leaf area index, dry matter accumulation, crop growth rate, rhizome growth and rhizome bulking rate and finally produced higher rhizome yield over their other levels.

Use of high level of Azotobacter increased only N content in rhizome and shoot over its lower levels and medium level of Phosphotica increased only P

content in rhizome and shoot over its higher and lower levels. Similarly, the N, P and K removal by rhizome and shoot as well as their total removal by the crop increased over control due to the use of biofertilizer. Application of high level of Azotobacter and medium level of Azospirillum and Phosphotica resulted in removing greater amount of N, P and K by rhizome, shoot and their total removal by the crop as compare to those of their other levels.

Application of higher dose of Azotobacter increased the dry matter, specific gravity and oleoresin content in rhizome over its low level. The crude fibre content in rhizome decreased with increasing dose of Azotobacter. Use of medium dose of Azospirillum and Phosphotica increased the specific gravity and oleoresin content in rhizome over those of their higher and lower levels. The dry matter content was also increased by the application of medium level of Phosphotica over its other levels.

The available P in soil increased with high dose of Azotobacter and medium level of both Azospirillum and Phosphotica treatments over their other levels. Though, available P content of the experimental soil increased considerably by biofertilizer application over control but it had no effect on available N and K content in soil. The results showed a slight decrease in available N content and a sharp decrease in available K content of the experimental soil from its initial values after two years of ginger cultivation.

High dose of Azotobacter increased the gross return (Rs 216511/- ha<sup>-1</sup>) over its medium (Rs 198309/- ha<sup>-1</sup>) and low (Rs 190759/- ha<sup>-1</sup>) levels. High dose of Azotobacter treatment paid greater profit (Rs 155220/- ha<sup>-1</sup>) and return per rupee invested (2.54) than those of its medium and low doses. The gross return, net return and return per rupee invested from ginger cultivation increased due to the application of medium dose of Azospirillum and Phosphotica over their high and low levels.

Combined use high level (5.0 kg ha<sup>-1</sup>) of Azotobacter with medium level (3.75 kg ha<sup>-1</sup>) of Phosphotica showed significant interaction effect on most of the growth attributes, yield attributes and yield of this crop. It recorded the highest values of most of the growth and yield parameters and ultimately produced the highest rhizome yield (22.08 t ha<sup>-1</sup>). This treatment combination removed significantly higher amount of N, P and K by rhizome, shoot and total N, P and K by the crop than other combinations. It also paid the highest gross return (Rs 220745/- ha<sup>-1</sup>), net return (Rs 158630/- ha<sup>-1</sup>) and return per rupee invested (2.55).