

## Effect of Biofertilizers and NPK Doses on Growth and Flowering of *Gladiolus (Gladiolus grandiflorus L.)*

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ARTICLE ID: 033

*Gladiolus (Gladiolus grandiflorus L.)* occupies a significant place among various flower crops of the world commercially grown for cut flower production. It is commonly known as sword lily, corn flag, and gladioli and regarded as “queen of bulbous flower” which belongs to family *Iridaceae*. The genus has many species like, *Gladiolus aurantiacus L.*, *Gladiolus blansus L.*, *Gladiolus byzantinus L.*, *Gladiolus primulinus L.*, *Gladiolus tristis L.* etc. It is grown in herbaceous border, bed, rockery, pot and also for cut flowers (Satapathy *et al.*, 2016).

*Gladiolus* is one of the most popular ornamental bulbous plants grown in many parts of the world for its bewitching flowers. Internationally it is known for its dazzling florets colour, sturdy spike, size, attractive appearance and keeping quality which occupies fifth position in the international trade. It is native to South Africa and ranks second among the bulbous cut flowers in the Netherlands market. Popularity of this crop as a cut flower, it is grown throughout the world which is potential money spinner for floriculture industry with the production about 120 million spikes per year (Sathyanarayana *et al.*, 2017).

It is being grown in an area of 11660 ha in the country with an estimated production of 106 crore cut flowers. Amongst the cut flowers, gladiolus occupied third position in terms of both area and production. The major gladiolus producing states in the country are Uttar Pradesh, West Bengal, Odisha, Chattisgarh, Harayana and Maharashtra. *Gladiolus* is also grown in states like Uttarakhand, Karnataka, Andhra Pradesh and Sikkim (Agricoop.nic.in. 2019)

The flower is popular for its majestic spikes which contain attractive, elegant, dazzling and delicate florets. These florets open in sequence over longer duration and hence have a good keeping quality of cut spikes. The colour range in gladiolus is fantastic and

almost any colour from near to black to white, pink, violet, lilace or mauve, greenish, smoky and combinations of these colours are also available. The spikes of gladiolus are mainly used for garden, interior decoration and for making bouquets. It has been great market value on the festival like of Diwali, Holi, New Year, Charismas and also on marriage ceremony. The best temperature for its better growth and spike production is 16-23°C while it can also tolerate extremely high temperature (40°C). In Northern Indian plains, the corms are planted at three times in a year mean (i) last week of February to mid March. (ii) July to August and (iii) second week of October to third week of November. Out of these, the third week of November is best suitable planting time of gladiolus in north India plains. Gladiolus may be grown on wide range of soils. Sandy loam soil is suitable for good flowering and corm yield. The most suitable pH range is 6-7. Heavy soils are not suitable for successful cultivation of gladiolus. Heavy soils cause poor drainage and rotting of corms in the soil. As regard the site, gladiolus response well to open sunny places. It is grown in open fields, beds, pots and a border etc. Gladiolus cultivar “White Prosperity” is one of the promising cultivars of northern India. The cultivar produces very attractive spikes and the flowering spike of the cultivar is in great demand in northern Indian flower markets. (Singh *et al.*, 2014).

Gladiolus is flowering plant with an un-branched stem that grows from a bulbous and rounded corm. Generally 1 to 9 longitudinal leaves can be found on the stem. The flowers are usually found in the same side on the stem. The flowers are usually found in the same side on the stem, and they are long and funnel shaped. The inflorescence, a spike, bears up to 25 florets arranged alternately on the axis. The numbers of various floral parts are in three. The outermost 3 segments are called calyx (sepal) and the next 3 corolla (true petals). Collectively, sepal and petals form perianth (tepals). Another dehisces in about 2-4 hr after opening of the perianth, when most of the pollen falls on the ground or lip of the lower tepals. (Jha *et al.*, 2018)

To ensure maximum productivity in any crop nitrogen, phosphorus and potassium are three major nutrients that play vital role in influencing vegetative growth, flower yield and quality attributes. However, considering the recent concept for eco-friendly technology, increased cost and timely non-availability of inorganic fertilizers, discriminate usage of chemicals leading towards poor soil fertility and soil health. In recent years, use of cost effective and eco-friendly bio-fertilizers and different organic sources in combination with

inorganic fertilizers have resulted in increased production in many crops besides improving soil health and fertility level along with that maintaining physical properties of soil and mobilization of nutrients. Similarly it is essential to evolve integrated nutrient management practice suitable for gladiolus (Sathyanarayana *et al.*, 2017).

Nitrogen and Phosphorous are two very essential major nutrient elements that influence growth and development of gladiolus to the great extent. However, use of these nutrient elements at very low or very high doses may not result in expected harvesting of the crop. Also, high dose application of these nutrient elements directly increases the cost of production that ultimately reduces net return of the farming. Balanced use of these two nutrient elements is a key to successful cut flower farming. Balanced application of nitrogen and phosphorous at definite recommended dose positively influences the growth and development, floral characteristics and vase life of gladiolus (Dhakal *et al.*, 2017).

Biofertilizers or more appropriately called microbial inoculants are the preparation containing live or latent cells of efficient strain of microorganisms. These may be biological nitrogen fixers, P-solubilising, mineralization of nitrogen and transformation of several elements like sulphur and iron into available forms. Continuous use of the biofertilizers results in gradual build up of their population in the soil which on many occasions leads to the stabilization of their effect even in the absence of fresh inoculation (Pradeep *et al.*, 2014). Common bio-fertilizers used in horticultural crops are *Azotobacter*, *Azospirillum*, phosphate solubilizing bacteria and VAM fungi. *Azospirillum* is a symbiotic N-fixing bacterium. *Azotobacter* and *Azospirillum* both fix atmospheric nitrogen when inoculated to plants, which help to save the application of N fertilizers to an extent of 20-25 per cent (Kumar 2014).

Microbial inoculants are the products containing the living cells (Mainly bacteria & fungi) that naturally activate the microorganisms found in the soil, restoring the soil fertility and improve physico-chemical and biological properties of soil. Certain strains of bio-fertilizers which are being commercially used are well known symbiotic N-fixing bacteria which help the plants indirectly through better nitrogen (N) fixation or improving the nutrient availability in the soil. They have the ability to fix 20-200 kg N/ha and increase crop yield by 10-50%. Application of 120:65:62.5 kg NPK per hectare + phosphobacteria + *Azospirillum* showed better results in vegetative and reproductive growth in gladiolus (Ali *et al.*, 2013).

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