

SABUJEEMA

An International Multidisciplinary e-Magazine

Volume 1 | Issue 7 | October, 2021

www.sabujeema.com

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Sabujeema Sabujeema
editorsabujeema@gmail.com
sabujeema-international
multidisciplinary-e-magazine





USES OF GIBBERELLIN (GA₃) IN AGRICULTURE AND HORTICULTURE

[Article ID: SIMM0141]

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GIBBERELLIN

Gibberellins are a plant hormone responsible for triggering seed germination and encouraging cell elongation and division. They are first produced by a seed when it is in the suitable conditions for growth: being warm, wet, and well oxygenated. Gibberellins break seed dormancy and stimulate germination. One of the functions of gibberellins is to stimulate the production of enzymes that break down the starchy food stores in seeds into simple sugars and amino acids. These sugars allow the cells in the plant embryo to initiate respiration, and the amino acids allow them to build proteins, leading to growth of the stem and roots. When the stem is long enough to be above soil and absorb light, the plant will start to photosynthesize to obtain food.

Practical uses of gibberellins in agriculture and horticulture are:

1. Synthesis of α -amylase
2. Fruit Production and parthenocarp
3. Elongation of internodes
4. Seed Production.
5. Extending shelf life
6. Modification of Sex expression
7. Seed germination
8. Breaking of bud dormancy
9. Flowering
10. Substitution for cold treatment

1. Synthesis of α -amylase:

- GA₃ promotes the synthesis of α -amylase enzymes in aleurone layer during germination.
- Hydrolysis of starch to provide energy to embryo.
- It is used to increase the amount of α -amylase in germinating barley (*Hordeum vulgare*) which is used in production of malt for brewing industry.
- GAs have also been used in increasing synthesis of various hydrolytic enzymes such as ribonuclease and protease in aleurone cells of barley grains to improve the yield.

2. Fruit Production and parthenocarp:

- GA treatment induces parthenocarp in the grapes (seedless fruits) and also produces **uniform bunches with large sized fruits** on commercial scale.
- Gibberellins cause stalks of grapes to increase considerably, so that there is more space for grapes to enlarge in the grape bunches.
- A mixture of the cytokinin benzyl adenine and GA₄ + GA₇ (the preparation being called as promalin) is very effective in stimulating apple fruits to increase in size especially in Red Delicious-type apples.
- Gibberellins cause fruits like apple to elongate and improve its shape.
- Gibberellins have also been sprayed on some citrus fruit trees (such as navel-orange) at a time when the fruits have lost most of their green colour, to prevent many post-harvest rind (fruit coat) disorders which appear during storage. Hence, gibberellins delay senescence and maintain firmer rinds of the fruits.
- It also causes lengthening of the peduncle thus forming larger bunch.
- It also improves the fruit quantities in cherries and enhances the flower bud formation.



- It helps in fruit setting even under non-ideal weather conditions.
- In Sweet Lime, spray of GA₃ at 10 ppm increased fruit set.

3. Elongation of internode and Increasing Yield:

- In sugarcane, the cane sugar (sucrose) is stored in parenchyma cells of internodes. Gibberellins stimulate elongation of internodes. Spraying the sugarcane crop with gibberellins markedly increases the length of sugarcane stem, thus increasing the yield by as much as 20 tonnes per acre. (The gibberellins promote the **elongation of sugarcane stalks** with no change in the sugar concentration thereby having a **net yield**).
- GAs also increase yield (fruit size) and parthenocarpic development in tomato and berries. Besides, GA treatment also causes broader and longer leaf formation in pea, bean, tomatoes, pepper, cucumber, lettuce and cabbage etc.

4. Seed Production:

- A mixture of GA₄ and GA₇ is used to enhance seed production in conifers.
- Spraying juvenile conifers with GAs hastens the maturity period, thus leading to early seed production.
- In some biennial vegetables such as beet, cabbage and many plants with rosette habit, gibberellin treatment stimulates bolting (internode elongation just prior to flowering) and thus time for seed production can be considerably reduced.

5. Extending shelf life:

- The gibberellins are treated on lemon, oranges and cherries to delay fruit maturity and senescence, it permits longer storage so that the longer marketing periods can be attained.
- They delay senescence. Hence the fruits are kept as fresh.

6. Modification of Sex expression:

- The gibberellins induce the production of male flowers on the plants which produces only female flowers. It produces hybrid cucumber seeds.

7. Seed germination:

- Certain light sensitive seeds e.g., lettuce and tobacco show poor germination in dark. Germination starts vigorously if these seeds are exposed to light or red light. This requirement of light is overcome if the seeds are treated with gibberellic acid in the dark.

8. Breaking of bud dormancy:

- In potatoes there is a dormant period after harvest, but the applications of Gibberellin help to break dormancy in "seed potatoes, sprouts the eye vigorously resulting in uniform crop emergence."

9. Flowering:

- GAs help in the flowering of many long day plants.
- Application of GA₃ 100-200 ppm in dahlia induces early flowering
- GAs help in the flowering of many long day plants.

10. Substituting cold treatment:

- Substituting the cold requirement with the gibberellins
- Induce flowering in biennials in a single year.

Conclusion

In conclusion it may be said that GA, originally obtained from the cultures of the fungus *Gibberella fujikuroi*, is present in different parts of higher plants. It induces internode extension, apical dominance, breaks dormancy, increases dry weight brings about flowering long day plants even when kept in short day conditions and replaces vernalisation.