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Effect of GA_3 and IAA on dormancy and seedling growth of fresh sesame [*Sesamum indicum* (L.)] seeds

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Abstract
In order to study effect of GA_3 and IAA on dormancy and seedling growth of fresh sesame [*Sesamum indicum* (L.)] seeds*"*an experiment was carried out in laboratory of the Department of Seed Science and Technology, College of Agriculture, Junagadh. Seed treatments consisted of control (untreated seeds), GA_3 (100, 200, 300 ppm) and IAA (100, 200, 300 ppm). The objective of this experiment were to determine the effect of gibberalic and indole acitic acid on germination of sesame and to find an effective method for breaking its seed dormancy. Results showed that GA_3 found effective for germination percentage, speed of germination and shoot length while IAA was found effective for increasing root length of seedlings, seedling dry weight and vigour index.

Keywords: Sesame, dormancy, seed treatment, germination

Introduction
Sesame (*Sesamum indicum*) is well known as one of the oldest oil seed crops used for consumption. On average, seeds contain about 50% of oil has better quality than other oil seed crop, is mostly utilized for making ghee (Yermonas *et al*., 1972) [15]. Sesame produces a unique chemical component that enables sesame oil to resist oxidative degradation and thus contributes to its reputation of having high quality oil. Although sesame has good drought tolerance compared with many other crops, it is particularly susceptible to drought during both the germination and seedling stages (Orruno and Morgan, 2007) [8].
Gibberlic acid (GA_3) can manipulate a variety of growth and developmental phenomena in various crops. Ashri and Palevitch (2008) [2] noted that dormancy completely broken by GA_3. Presoaking treatment of GA_3 triggers the activity of specific enzymes that promotes early germination such as α-amylase which increases in availability of starch assimilation. Chatterji *et al.* reported that sesame seeds treated with GA_3 solution (500mg/l) germinated faster than the untreated seeds.
This study was undertaken to evaluate sesame seed germination, first count of germination, speed of germination, shoot length, seedlings weight fresh and vigour index after soaking the seeds with three level of GA_3.

Materials and Methods
Sesame seeds were used for this study. The investigation was conducted at the Seed Testing Laboratory, Department of Seed Science & Technology with an objective to determine the rate of seed germination and seedling growth which influenced by various concentrations of growth regulators. Seeds were collected from instructional farm, krishigadh, Junagadh which were stored under ambient storage condition (32± 1°C) temperature till used for the experimentation.
The seeds were treated under different concentrations of 100, 200 and 300 ppm of GA_3 and IAA with a separate control set (Table 1). These were soaked for 24 hours in the above concentrations.

Table 1: The treatments of GA_3 and IAA with different concentrations

Treatments	Concentration (ppm)	Growth hormone	Seed soaked time (hrs)
T_1 (control)	---	---	24
T_2	100	GA_3	24
T_3	200	GA_3	24
T_4	300	GA_3	24
T_5	100	IAA	24
T_6	200	IAA	24
T_7	300	IAA	24

Results and Discussion

Germination percentage

An experiment was conducted to determine the germination percentage of dormant sesame seeds with the different concentrations of GA_3 and IAA. The seeds were soaked in concentrations (100, 200, 300 ppm) of GA_3 and IAA for 24 hrs. significant variation was found among the treatments GA_3 (300 ppm) showed the highest germination percentage in contrast to other treatments. Highest germination percentage of GA_3 (92.63%) was found more as compare to control T_1 (56.20%) Fig. 1. These findings may be due to presoaking treatment of GA_3 which would have triggered the activity of specific enzymes that promoted early germination such as α-amylase which have brought an increase in availability of starch assimilation. Similar results were obtained others, Ashri and Palevitch (2008) [2] and Subash *et al*. (2015) [13] working with GA_3 in sesame, concluded that GA_3 is necessary for facilitating for germination.

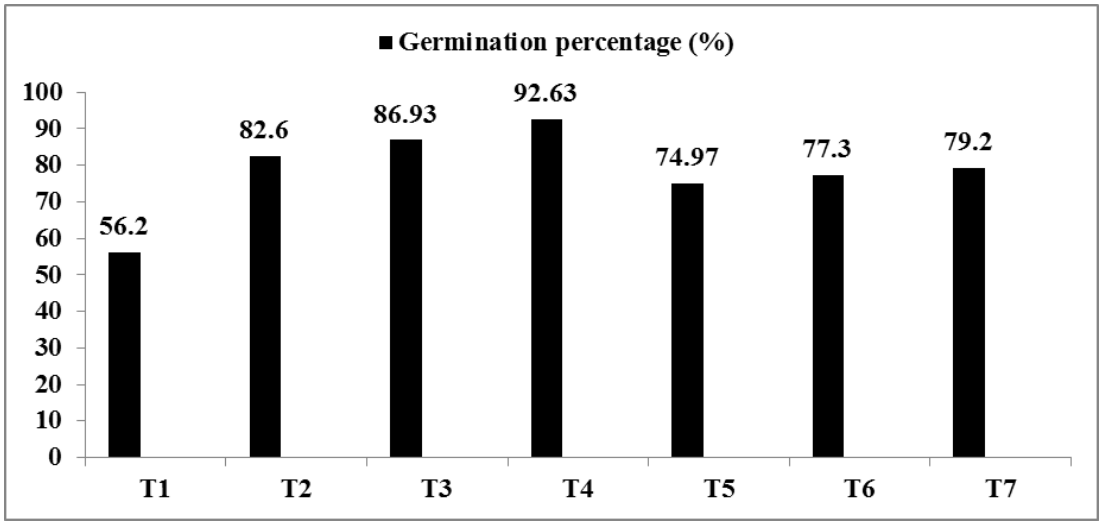

Fig 1: Effect of pre-sowing treatments of growth regulators on germination.

Speed of germination

The highest speed of germination (22.20) than the other seed treatments and treatment concentration was recorded by GA_3 (300 ppm) while the lowest speed of germination (17.49) was recorded by control (T_1). These results were in accordance with the findings of Ashri and Palevitch (2008) [2] in sesame, Assefa *et al*. (2010) [3] in soybean and Pulok *et al.* (2015) [9] in lentil.

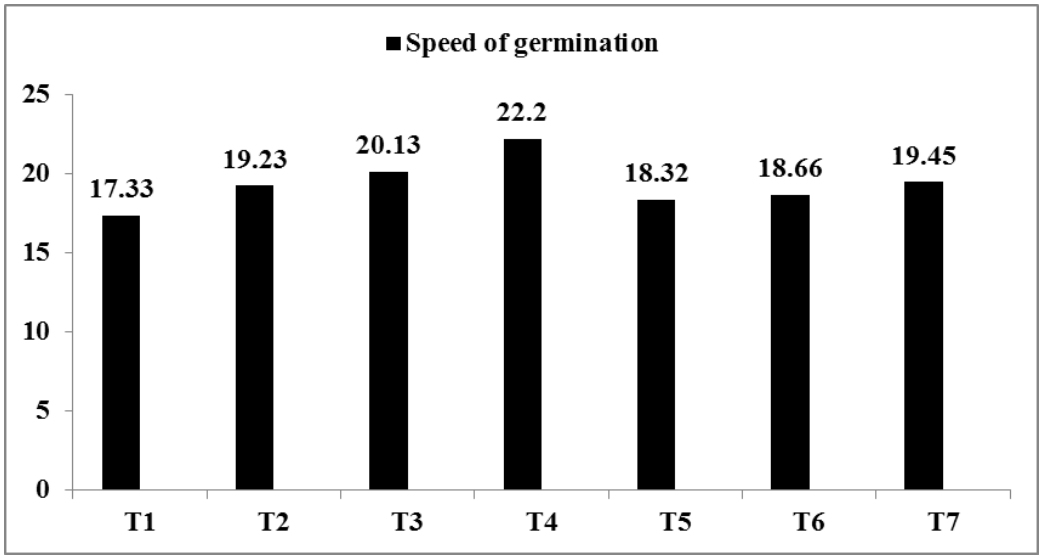

Fig 2: Effect of pre-sowing treatments of growth regulators on speed of germination

Shoot length of seedlings

Seeds treated with GA_3 (300 ppm) (T_4) recorded significantly the highest shoot length of seedlings (5.73 cm) than the other seed treatments while significantly the lowest shoot length of seedlings was recorded by control (T_1) (4.03 cm). It might be due to additional GA_3 activated α-amylase which digested the available carbohydrates into simple sugar so that energy and nutrition were easily available to faster growing seedlings. These results are in accordance with the findings of Dhoran and Gudadhe (2012) [6] in Asparagus, Sarkar *et al.* (2002) [12] in soybean, Toklu (2015) [14] in lentil, Assefa *et al*. (2010) [3] in soybean, Chauhan *et al.* (2009) [5] in black gram, Saeedipour (2013) [11] in cowpea and Agawane *et al.* (2015) [1] in soybean.

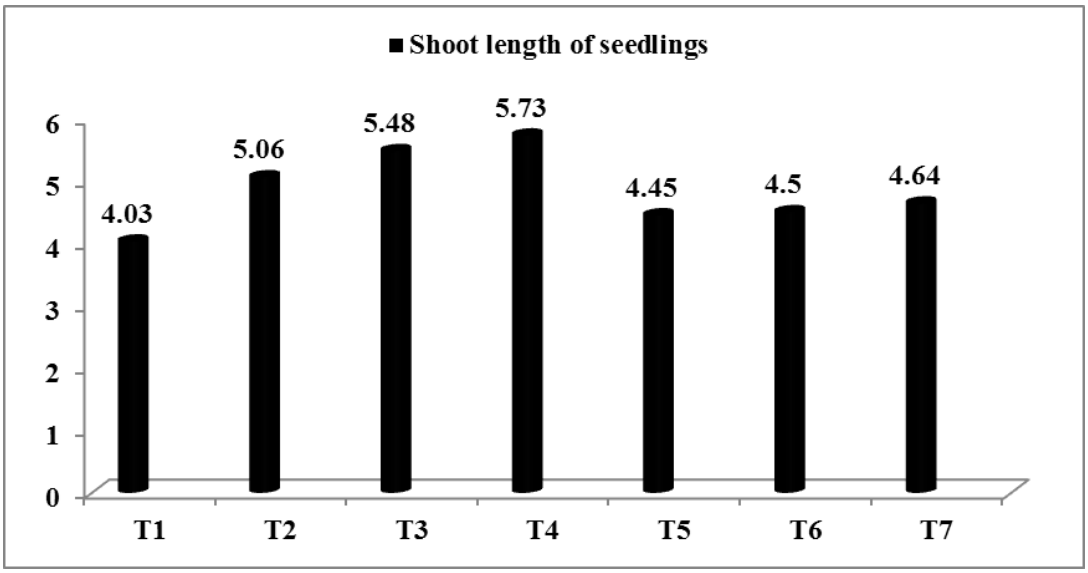

Fig 3: Effect of pre-sowing treatments of growth regulators on shoot length of seedlings (cm)

Root length of seedling

Different seed treatments significantly influenced the root length of seedlings. Seeds treated with IAA (300 ppm) (T_7) recorded significantly the highest root length of seedlings (6.19 cm) while significantly the lowest root length of seedlings was recorded by control (T_1) (4.47 cm) (Table 4.2.1). As IAA is essential for cell division or cell enlargement or both, because growth of the plant occurs by two process i.e. cell division by mitosis which adds new cells and elongation of already existing cells which in turn increase the root length. It might be due to more production of photosynthates and their translocation through phloem to the root zone which responsible for improving root length. Similar results were obtained by Mukundam *et al*. (2008) [7] in rice working with IAA.

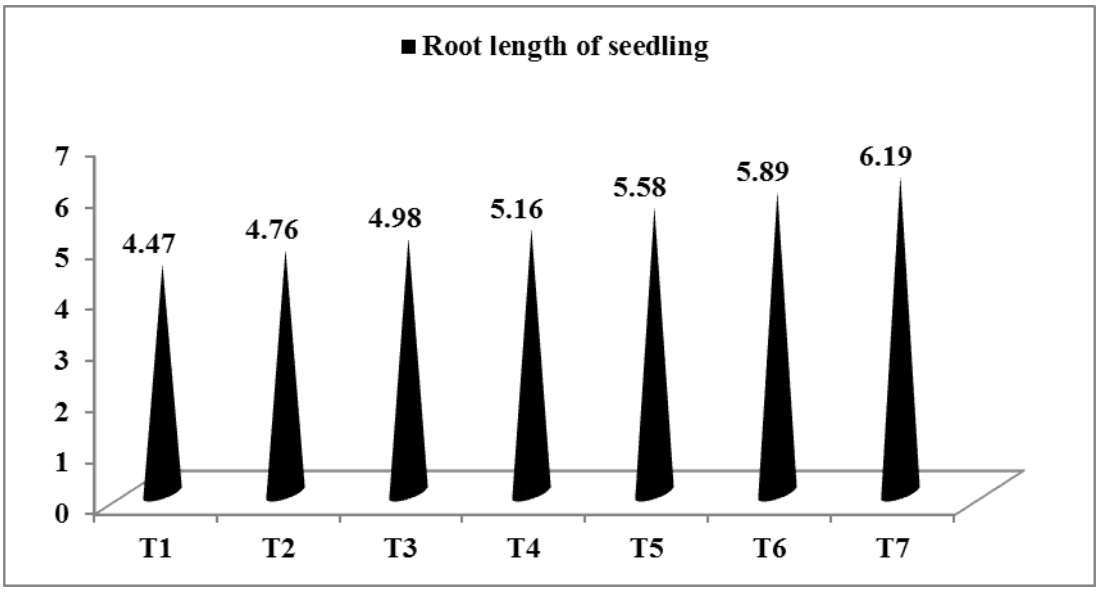

Fig 4: Effect of pre-sowing treatments of growth regulators on germination root length of seedlings (cm)

Seedling dry weight

The results showed that different seed treatments significantly influenced the seedlings dry weight. Seeds treated with IAA (300 ppm) (T_7) recorded significantly the highest seedlings dry weight (0.040 g) than the other seed treatments while significantly the lowest seedlings dry weight (0.017 g) was recorded by control (T_1). Similar findings obtained by Saeedipour (2013) [11] in cowpea and Rastogi *et al*. (2013) [10] in linseed.

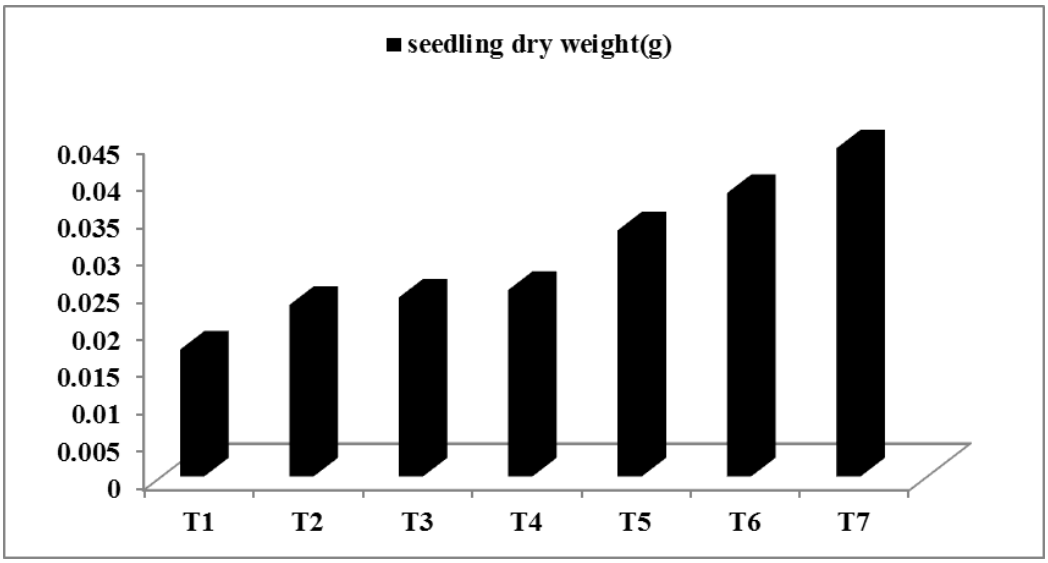

Fig 5: Effect of pre-sowing treatments of growth regulators on seedlings dry weight (g)

Seed vigour index

Seeds treated with IAA (300 ppm) (T_7) recorded significantly the highest seed vigour index (3.17) than the other seed treatments while significantly the lowest seed vigour index was recorded by control (T_1) (0.96). The highest vigour index under seed treatment might be due to higher germination percentage, average seedlings dry weight and low frequency of weak seedlings.

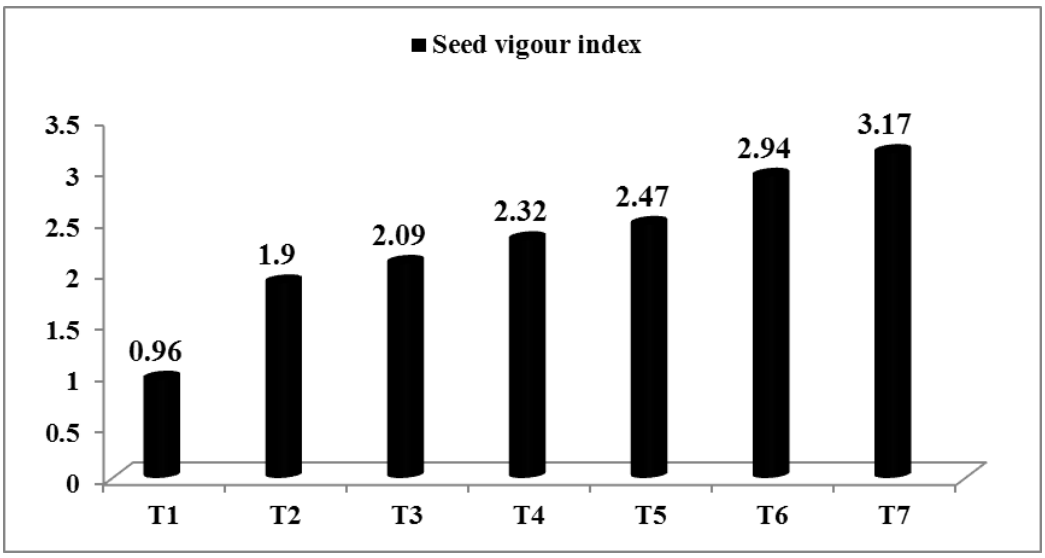

Fig 6: Effect of pre-sowing treatments of growth regulators on seed vigour index

Conclusion

Pre-sowing treatment of sesame seeds with 300 ppm of GA_3 significantly increases germination percent, speed of germination and shoot length of seedling and IAA with 300ppm increases root length of seedling, seedling dry weight and seed vigour index. It may be concluded that performances of sesame seeds, in terms of different germination and vigor characteristics, were better when growth regulator's components used and when seeds were soaked by higher concentrations of different growth regulators may make a significant effect in many of those seed germination and vigor parameters, as evidenced in the case sesame of this experiment.

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