

Avocado seeds germination: changes which occur in seed composition during the germination process and the effect of plant growth regulators on germination

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1971. Final Thesis – MSc in Agricultural Sciences.
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Summary

This work is divided into two sections; the subjects of both are associated with the germination process of avocado seeds. In trials conducted in the first section the effect of exogenous plant growth regulators on seed germination and on the rate of the seedling development were studied. In the second part the changes that occurred in the composition of the cotyledons of the avocado seeds during germination and the initial stages of the seedling growth were studied.

Subject A: The effect of plant growth regulators on seed germination and on the nevatim (sprouts) development

The purpose of the trial was to test whether there is a possibility to advance the germination and to increase the rate of the seedlings growth, thus shorten the period between planting of the seeds and grafting.

Avocado seeds of the Guatemalan cultivar 'Ford', the Mexican cultivars 'Mexicola' and 'Northrop' and the West Indian cultivar 'Bet-Dagan11/16' were soaked before planting for a period of 24 hours in plant growth regulator solutions or in distilled water.

The plant growth regulators that were included in the trials were:

- Auxins – NAA, 2,4-D
- Cytokinins - Kinetin, B.A.P
- Gibberellins – GA₃

The PGR's that were found to be most effective in the advancement of the time of grafting are:

- GA₃ in 1000 ppm concentration; B.A.P in 100 ppm concentration; and 2,4-D in 100ppm concentration.
- N.A.A. - Delayed both germination and sprouting in most trials.
- Kinetin - Caused a delay in both germination and sprouting.
- Distilled water – Somewhat delayed germination and delayed germination significantly.
- B.A.P – Caused ramification of the seedlings in the cultivar 'Northrop', and the development of several shoots from a single seed in the West Indian cultivar 'Bet-Dagan 11/16' apparently from the weakening of the apical dominance.

Subject B: Changes that occur in the composition of avocado seeds during germination

During seed germination of the Guatemalan cultivar 'Nabal' and seeds of the West Indian cultivar 'Bet-Dagan 11/16' the changes in the composition of the cotyledons were tested. The carbohydrate proportionality was tested – starch, and overall sugars - in the cotyledons, and also the proportionality of the various minerals: nitrogen, potassium, phosphorous, chlorine, sodium, calcium, magnesium, iron and boron. We found that two processes occurred simultaneously in the seeds.

a) Emptying process – that was characterized by rapid decreases in the dry weight of the seeds and in the level of the starch, nitrogen, phosphorous and boron.

The disappearance of these components indicates to be likely a process of breakdown of stored materials and their transfer to the developing seedling. One of the evidence is the increase in the dissolved sugars in parallel with the decrease in the starch level. The emptying process commenced in the stage where a significant growth of roots and shoots took place.

Irrigating the seeds with distilled water caused delay in the breakdown of the starch, and the translocation of the nitrogen, potassium and phosphorus from the cotyledons, when compared to irrigation with regular water. There is a possibility that the causes of the delay were different growing conditions, since seeds that were irrigated with distilled water were kept in a greenhouse. There were no significant differences between seeds that were planted in vermiculite which is inert, and seeds that were planted in soil.

b) Absorption process - chloride, sodium, magnesium, and calcium concentrated in the seed during germination. This concentration was more noticeable in seeds planted in soil, and was less evident in seeds that were planted in vermiculite and were irrigated with regular water, and did not occur at all in seeds that were planted in vermiculite and were irrigated with distilled water. It appears that the main source of the concentration of this element is the commercial water, but there a greater absorption of these elements in soil.

Seeds of the Guatemalan cultivar 'Nabal' contained before planting more chlorine, sodium and calcium than the West Indian cultivar 'Bet-Dagan 11/16' and also concentrated more of these elements during germination. It appears that traits associated with the resistance of West Indian rootstocks under salty condition and excess of carbonates are noticed already in the seed composition before planting and during germination.