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BREAKING DORMANCY OF POTATO TUBERS

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BREAKING DORMANCY OF POTATO TUBERS

Potato seed tubers should be allowed to pass through their normal period of dormancy and to sprout naturally. However, seed tubers are often needed before sprouting occurs, as can be the case in seed tuber programs when two or three crops are grown each year, or when working with genetic material. In these circumstances, it may be necessary to break dormancy, or rest period, as soon after harvest as possible.

1 BREAKING DORMANCY

When working with commercial varieties, the different chemicals that can be used and the concentrations needed for dormancy breaking can be standardized for routine application. However, different types of genetic materials react differently to the various chemicals that promote sprouting. Therefore, it is essential to know the genetic background of the materials before selecting a particular method or chemical for breaking dormancy. Usually, but not always, late maturing clones have a long dormancy that is more difficult to break than that of early maturing clones.

Tubers whose dormancy is broken by chemical treatment often show apical dominance, which is a phenomenon when only one eye on a tuber develops a sprout. This occurs in many varieties and is very common in breeding material. A single sprout gives rise to a one-stemmed plant which is undesirable because it produces few, large tubers. Apical dominance can be overcome by removing the single sprout and this causes other eyes to sprout. However, on tubers of less than 15-20 g, it is desirable to have only one sprout. It is also recommended to remove the first sprouts to reduce any adverse effects of the chemical used.

The method used to break dormancy will probably depend on the facilities and chemicals available, as well as the genetic characteristics of the breeding material and varieties to be treated. When using chemicals, always read and follow the manufacturer's instructions. Do not take chances. Consider all chemicals as dangerous.

Several methods are available and can be used singly or in combination.

2 TEMPERATURE TREATMENTS

Heat. Tubers are kept in a dark room at 18-25 ^{o}C until sprouting occurs. This method works best on very early maturing cultivars or when the dormant period is almost completed. It is not recommended for segregating populations or other breeding material.

Cold shock plus heat. This method also works best with early maturing varieties or when the dormant period is almost finished. It can be utilized with some breeding materials of different genetic background. The tubers are harvested, cleaned and allowed to suberize (cuts and bruises healed). They are placed in 4 ^{o}C for two or more weeks, and then held at 18-25 ^{o}C. If sprouts do not appear within two to three weeks, either repeat the process or treat the tubers with gibberellic acid.

3 GIBBERELLIC ACID

Freshly harvested tubers are cleaned and dipped in a solution of gibberellic acid (GA3) for 10-20 minutes. Best results are obtained if treatment is done before cuts and bruises are healed. For many varieties and breeding materials, GA3 hastens sprouting when the dormancy period has nearly finished. There are many different recommendations as to the GA3 concentration to use: the rate often depends on the material and its stage of dormancy.

It is recommended to use solutions containing 5-10 ppm GA3 to treat all types of tubers, especially those that are old or having many cuts and bruises. Higher concentrations - never over 100 ppm - can be used on suberized, freshly harvested tubers.

Caution: High concentrations may cause hair-like sprouts, poor emergence, and atypical vines. Never use concentrations greater than 2 ppm on tubers with sprouts. After treatment, tubers should be air-dried and held at 18-25 ^{o}C until sprouting occurs. Remove the first sprouts to reduce the adverse effects of GA3.

4 THIOUREA

Soak tubers in a 1 % aqueous solution of thiourea for one hour. If the tubers do not have cuts and bruises, make one or two incisions on the heel (stolon) end to ensure absorption of the chemical. The solution can be used for several batches of tubers if they are free from soil. After treatment, air-dry and store at 18-25 ^{o}C. This treatment can be used in combination with other methods but should always be carried out last since it is necessary to make incisions in the tubers. This method, although safe, is not popular.

5 ETHYLENE CHLOROHYDRIN

Ethylene chlorohydrin (2-chloroethanol) is a dangerous chemical and should be handled very carefully. Use 7 cm^3 of chemical per liter of water. Ethylene chlorohydrin dip must not be used with cut or bruised tubers as these will rot rapidly as a result of the treatment. Place clean, well-suberized tubers in a mesh bag and immerse in the solution until the entire surface of all the tubers are wet. The tubers are removed from the solution and immediately placed on a rack in an airtight container for two or three days. The racks ensure that the tubers are not in contact with the excess solution that drains from them.

Ethylene chlorohydrin is highly volatile and the gas aids in breaking dormancy. Wear rubber gloves and apron while handling the wet tubers. Remove the tubers, air-dry and hold at 18-25 ^{o}C. This method is recommended for genetic materials, especially when the tubers are less than 10 g. Use extreme care when transporting this chemical.

6 RINDITE

Rindite is a mixture of

- 7 parts ethylene chlorohydrin (2-chloroethanol)
- 3 parts ethylene dichloride (1,2-dichloroethanol)
- 1 part carbon tetrachloride

The carbon tetrachloride is used to hasten volatilization of the mixture. Rindite is extremely volatile, very dangerous, and corrosive. Users should wear rubber gloves, shoes, apron, and a mask, and never allow the chemical to come into contact with the skin. Tubers to be treated must be sound and free of cuts and bruises. They should be placed in an airtight container with an outside, closed air-circulation system for large quantities. Small lots of tubers (less than 5 kg) do not need the circulation system. Prior to treatment, keep the tubers for five to seven days at 18-20 ^{o}C in high humidity and with adequate air movement to ensure suberization. Extreme care should be taken in transporting this chemical.

Apply 210 cm^3 of rindite per m^3 of air space. Apply 1/3 of the amount each day for three days. The rindite liquid should be placed in a dish with cotton or paper towels to ensure rapid volatilization and should never touch the tubers. Hold the chamber at about 25 ^{o}C during the three-day treatment period. After treatment, provide good aeration to free the container of the gas. If a walk-in treatment chamber is used, it should be provided with an exhaust fan.

After treatment, keep the tubers at 18-25 ^{o}C until sprouting occurs. If used on tubers with sprouts, the sprouts will be lost and tubers. The dose may be increased when treating varieties whose dormancy is extremely difficult to break. GA3 or thiourea can be used after the use of rindite if sprouts do not appear.

7 CARBON DISULPHIDE

Carbon disulphide (CS_2) is a volatile liquid which evaporates rapidly. The gas is flammable and poisonous. The method of application is similar to that used for rindite, and the recommended dosage rates vary from country to country. In Brazil 45 cm^3 of CS_2 is used per m3 of container volume for three days at 20-25 ^oC, and in India 50 cm^3/ton of potatoes for two weeks. Experiments in The Netherlands using 12.5 to 25 cm^3/m^3 of container volume for three days at 20 ^oC have given successful results. The use of high concentrations can cause hair sprouts. Tubers to be treated with CS_2 must be mature and well suberized.

8 BROMOETHANE

Bromoethane (C_2H_5Br) is a flammable liquid that can be used at 0.2 cm^3 per dm^3 of container space on newly harvested tubers or 0.1 cm with tubers close to the end of the dormancy period for 24 hours at room temperature. Tubers must be mature and well suberized prior to treatment. Place the liquid bromoethane in a container (beaker) with wicks to aid in evaporation. Air circulation is needed as the gas formed is heavier than air. After treatment hold tubers at 17 to 20 ^oC until sprouts appear.

Proper precautions must be taken as the liquid plus gas can be toxic to mammals. This chemical is somewhat safer to use and transport than rindite or ethylene chlorohydrin. It is very flammable at higher concentrations.

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