بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Agricultural Studies

Department of Horticulture

Effect of Treatment (Sulfuric Acid, Scratching, Soaking in Water, Hot Water and Hot and Cold Water) on the Germination of Carob Seeds

A dissertation submitted to Sudan University of Science and Technology in partial fulfillment of the requirements of the degree of B.Sc. Honours in Horticulture

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الآية

قال تعالى:

(أَتَأْمُرُونَ النّاسَ بِالْبِرِّ وَتَنْسَوْنَ أَنْفُسَكُمْ وَأَنْتُمْ تَتْلُونَ الْكِتَابَ أَفَلَا تَعْقِلُونَ)

صدق الله العظيم

سورة البقرة الآية (44)

Dedication

To the fountain of patience and optimism and hope

To each of the following in the presence of God and His

Messenger, my mother dear

To the big heart my dear father

To those who have demonstrated to me what is the most beautiful

of my brothers life

To the people who paved our way of science and knowledge

All our teachers Distinguished

To the taste of the most beautiful moments with my friends

I guide this research

Acknowledgments

First praise and thanks to ALLAH to spire me to work on this topic and giving me strength and patine to complete this work successfully. I would like to express my deepest and sincere gratitude and thanks full to my Great Supervisor: **Dr. Yassin Abd-Elrahman Makkawi** for his very supportness and kind, and a wonderful care in directing and supervising work.

Thanks also to all whom help me in my research.

Finally thanks to my mother for take care and help and hope her health and happiness forever.

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الخلاصة

أجريت هذه الدراسة بمشتل النباتات الطبية بكلية الدراسات الزراعية جامعة السودان للعلوم والتكنولوجيا- شمبات في الموسم الزراعي2016-2017 لكسر سكون وإنبات بذور نبات الخروب في تربة الخرطوم بعدد من المعاملات المختلفة لكسر السكون (حامض الكبريتيك، الكشط، النقع في الماء، النقع في الماء الساخن والبارد والماء الساخن فقط) وتم أخذ العينات من مدينة أبو جبيهة- ولاية جنوب كردفان وأوضحت نتائج تحليل القطاعات كاملة العشوائية أن المعاملة بحامض الكبريتيك هي الأنسب لكسر سكون البذور وإنباتها.

Abstract

This study was conducted at the Faculty of Agricultural Studies, Sudan University of Science and Technology, in the agricultural season 2016-2017, to break the dormancy and germination of the seeds of the carob plant in the Khartoum soil with a number of different treatments of sedimentation (sulfuric acid, abrasion, soaking in water, soaking in hot water,) And samples were taken from the city of Abu Jbeha - State of South Kordofan The results of the analysis of the whole random sectors showed that the treatment of sulfuric acid is best suited to break the dormancy of seed and germination.

CHAPTER ONE

INTRODUCTION

The interest in medicinal and aromatic plants is due to the fact that it is the first major source of access to medicines since the beginning of creation, where humans used plants in their food and to ease their pain and treat their various diseases by using one part of the plant or whole plant after soaking, boiling or And the search for the substance that contains the cause of the therapeutic act or part of the plant therapeutic benefit, but depending on the experience only and the progress of science and technology scientists can separate the active substances from the plants contained and prepared in a manner suitable for use and the situation Sick used for.

Human beings have known human medicinal and aromatic plants for a long time and have given much knowledge and information about these plants in ancient civilizations such as the civilization of the ancient Egyptians, India, China, Muslims, etc.

As the science developed, it was able to grind the medicinal plant and make it powder. In the 18th century, medicinal plants appeared in pharmacies in the form of extracts or tinctures that became more concentrated, effective and easier to prepare and eat. With the advancement of applied science, especially chemistry and knowledge of scientists to the methods of chemical analysis, scientists have been able to separate the active substances in the plants and manufacture in pure form in the form of tablets or paint or injection and jealousy(2001).

The medicinal and aromatic plants have great economic importance for the following reasons:

It enters into the pharmaceutical industry and is used in folk medicine, thus providing public health guarantees as well as pharmaceutical raw materials.

Egypt exports large quantities of these plants and their products, which brings foreign currencies necessary to raise the economic level of the country.

Are grown in newly reclaimed areas, thus providing the old agricultural area for food crops, fodder and clothing.

Enter the agricultural cycle to diversify the crops so as to reduce the risk of dependence on a single crop, and the lack of agricultural stress.

They can be exported dried and some of them are extracted from oils, pastries or extracts, some of which can be exported fresh, which increases export opportunities throughout the year and depending on the needs of importers and foreign markets

Objectives:

The aim of this study is investigate the relationship between the seed coat dormancy of Ceratonia siliqua l seed and natural habitat. the determination of effect of water soaking, sulfuric acid,and scratching on germination . And the possibility of planting it in the soil of Khartoum.

CHAPTER TWO

LITERATURE REVIEW

A dormant seed is one that is unable to germinate in a specified period of time under a combination of environmental factors that are normally suitable for the germination of the non-dormant seed. Dormancy is a mechanism to prevent germination during unsuitable ecological conditions, when the probability of seedling survival is low.

One important function of most seeds is delayed germination, which allows time for dispersal and prevents germination of all the seeds at the same time. The staggering of germination safeguards some seeds and seedlings from suffering damage or death from short periods of bad weather or from transient hereivores ; it also allows some seeds to germinate when competition from other plants for light and water might be less intense. Another form of delayed seed germination is seed quiescence, which is different from true seed dormancy and occurs when a seed fails to germinate because the external environmental conditions are too dry or warm or cold for germination. Many species of plants have seeds that delay germination for many months or years, and some seeds can remain in the soil seed bank for more than 50 years before germination. Some seeds have a very long viability period, and the oldest documented germinating seed was nearly 2000 years old .

True dormancy or innate dormancy is caused by conditions within the seed that prevent germination under normally ideal conditions. Often seed dormancy is divided into two major categories based on what part of the seed produces dormancy: exogenous and endogenous. There are three types of dormancy based on their mode of action: physical, physiological and morphological (Fenner, Michael; Thompson, Ken (2005).

There have been a number of classification schemes developed to group different dormant seeds, but none have gained universal usage. Dormancy occurs because of a wide range of reasons that often overlap, producing conditions in which definitive categorization is not clear. Compounding this problem is that the same seed that is dormant for one reason at a given point may be dormant for another reason at a later point. Some seeds fluctuate from periods of dormancy to non dormancy, and despite the fact that a dormant seed appears to be static or inert, in reality they are still receiving and responding to environmental cues.

Exogenous dormancy:

Exogenous dormancy is caused by conditions outside the embryo and is often broken down into three subgroups.

Physical dormancy

Dormancy that is caused by an impermeable seed coat is known as physical dormancy. Physical dormancy is the result of impermeable layer(s) that develops during maturation and drying of the seed or fruit (Offord, C.A. and Meagher, P.F. (2009). This impermeable layer prevents the seed from taking up water or gases. As a result, the seed is prevented from germinating until dormancy is broken. In natural systems, physical dormancy is broken by several factors including high temperatures, fluctuating temperatures, fire, freezing/thawing, drying or passage through the digestive tracts of animals. Physical dormancy is believed to have developed Once physical dormancy is broken it cannot be reinstated i.e. the seed is unable to enter secondary dormancy following unfavorable conditions unlike seeds with physiological dormancy mechanisms. Therefore, the timing of the mechanisms that breaks physical dormancy is critical and must be tuned to environmental cues. This maximizes the chances for germination occurring in conditions where the plant will successfully germinate, establish and eventually reproduce (Baskin, J.M. and Baskin, C.C. and Li, X. (2000))

Physical dormancy has been identified in the seeds of plants across 15 angiosperm families including:

- Anacardiaceous
- Bixaceae
- Cannaceae (monocot)
- Cistaceae
- Cochlospermaceae
- Convolvulaceae
- Cucurbitaceae
- Dipterocarpaceae
- Geraniaceae
- Legumeinosae

Physical dormancy has not been recorded in any gymnosperms. Generally, physical dormancy is the result of one or more palisade layers in the fruit or seed coat. These layers are lignified with amphibian cells tightly packed together and impregnated with water-repellent. In the Anacardiaceous and Nelumbonaceae families the seed coat is not well developed. Therefore, palisade layers in the fruit perform the functional role of preventing water uptake . While physical dormancy is a common feature, several species in these families do not have physical dormancy or produce non-dormant seeds.

Specialized structures, which function as a "water-gap", are associated with the impermeable layers of the seed to prevent the uptake of water. The water-gap is closed at seed maturity and is opened in response to the appropriate environmental signal. Breaking physical dormancy involves the disruption of these specialized structures within the seed, and acts as an environmental signal detector for germination. For example, legume (Fabaceae) seeds become permeable after the thin-walled cells of lens (water-gap structure). Following disrupted pulls apart to allow water entry into the seed. Other water gap structures include capillary micro Pyle, bixoid chalazal plug, imbibitions lid and the suberised ‘stopper’.

In nature, the seed coats of physically dormant seeds are thought to become water permeable over time through repeated heating and cooling over many months-years in the soil seed bank. For example, the high and fluctuating temperatures during the dry season in northern Australia promote dormancy break in impermeable seeds of *Stylosanthes humilis* and *S.hamata* (Fabaceae).

Mechanical dormancy:

Mechanical dormancy occurs when seed coats or other coverings are too hard to allow the embryo to expand during germination(March 22, 2007, at the Wayback Machine). In the past this mechanism of dormancy was ascribed to a number of species that have been found to have endogenous factors for their dormancy instead. These endogenous factors include low embryo growth potential.

Chemical dormancy:

Includes growth regulators etc., that are present in the coverings around the embryo. They may be leached out of the tissues by washing or soaking the seed, or deactivated by other means. Other chemicals that prevent germination are washed out of the seeds by rainwater or snow melt.

Endogenous dormancy:

Endogenous dormancy is caused by conditions within the embryo itself, and it is also often broken down into three subgroups: physiological dormancy, morphological dormancy and combined dormancy, each of these groups may also have subgroups.

Physiological dormancy:

Physiological dormancy prevents embryo growth and seed germination until chemical changes occur (Fenner, Michael; Thompson, Ken (2005). These chemicals include inhibitors that often retard embryo growth to the point where it is not strong enough to break through the seed coat or other tissues. Physiological dormancy is indicated when an increase in germination rate occurs after an application of gibberellic Acid (GA3) or after Dry after-ripening or dry storage. It is also indicated when dormant seed embryos are excised and produce healthy seedlings: or when up to 3 months of cold (0–10 °C) or warm (=15 °C) stratification increases germination: or when dry after-ripening shortens the cold stratification period required. In some seeds physiological dormancy is indicated when scarification increases germination.

Physiological dormancy is broken when inhibiting chemicals are broken down or are no longer produced by the seed; often by a period of cool moist conditions, normally below (+4C) 39F, or in the case of many species in Ranuncullaceae and a few others,(−5C) 24F.Abscisic acid is usually the growth inhibitor in seeds and its production can be affected by light. Some plants like peony species have multiple types of physiological dormancy, one affects radicle (root) growth while the other affects plumule (shoot) growth. Seeds with physiological dormancy most often do not germinate even after the seed coat or other structures that interfere with embryo growth are removed. Conditions that affect physiological dormancy of seeds include:

- **Drying**; some plants including a number of grasses and those from seasonally arid regions need a period of drying before they will germinate, the seeds are released but need to have a lower moisture content before germination can begin. If the seeds remain moist after dispersal, germination can be delayed for many months or even years. Many herbaceous plants from temperate climate zones have physiological dormancy that disappears with drying of the seeds. Other species will germinate after dispersal only under very narrow temperature ranges, but as the seeds dry they are able to germinate over a wider temperature range (G. Nicolas. 2003..)

- **Photodormancy** or light sensitivity affects germination of some seeds. These photoblastic seeds need a period of darkness or light to germinate. In species with thin seed coats ,light may be able to penetrate into the dormant embryo. The presence of light or the absence of light may trigger the germination process, inhibiting germination in some seeds buried too deeply or in others not buried in the soil.

- **Thermo dormancy** is seed sensitivity to heat or cold. Some seeds including cockllebur and amaranth germinate only at high temperatures (30C or 86F). Many plants that have seeds that germinate in early to mid summer have thermo dormancy and germinate only when the soil temperature is warm. Other seeds need cool soils to germinate, while others like celery are inhibited when soil temperatures are too warm. Often thermo dormancy requirements disappear as the seed ages or dries.

Seeds are classified as having deep physiological dormancy under these conditions: applications of GA3 does not increase germination; or when excised embryos produce abnormal seedlings; or when seeds require more than 3 months of cold stratification to germinate.

Morphological dormancy:

In morphological dormancy, the embryo is underdeveloped or undifferentiated. Some seeds have fully differentiated embryos that need to grow more before seed germination, or the embryos are not differentiated into different tissues at the time of fruit ripening.

Immature embryos – some plants release their seeds before the tissues of the embryos have fully differentiated, and the seeds ripen after they take in water while on the ground, germination can be delayed from a few weeks to a few months.

Combined dormancy

Seeds have both morphological and physiological dormancy.

Morpho-physiological or **morphophysiological dormancy** occurs when seeds with underdeveloped embryos, also have physiological components to dormancy. These seeds therefore require dormancy-breaking treatments as well as a period of time to develop fully grown embryos.

- Intermediate simple
- Deep simple
- Deep simple epicotyl
- Deep simple double
- Intermediate complex
- Deep complex

Combinational dormancy:

Combinational dormancy occurs in some seeds, where dormancy is caused by both exogenous (physical) and endogenous (physiological) conditions. Some lris species have both hard impermeable seeds coats and physiological dormancy.

Secondary dormancy:

Secondary dormancy occurs in some non-dormant and post dormant seeds that are exposed to conditions that are not favorable for germination, like high temperatures. It is caused by conditions that occur after the seed has been dispersed. The mechanisms of secondary dormancy are not yet fully understood but might involve the loss of sensitivity in receptors in the plasma membrane(Bewley, J. Derek, and Michael Black. 1994.)

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Not all seeds undergo a period of dormancy, many species of plants release their seeds late in the year when the soil temperature is too low for germination or when the environment is dry. If these seeds are collected and sown in an environment that is warm enough, and/or moist enough, they will germinate. Under natural conditions non dormant seeds released late in the growing season wait until spring when the soil temperature rises or in the case of seeds dispersed during dry periods until it rains and there is enough soil moisture.

Seeds that do not germinate because they have fleshy fruits that retard germination are quiescent, not dormant.

Introduction

The carob Ceratonia ciliqua l tree has been grown since antiquity in most countries of the Mediterranean basin, usually in mild and dry places with poor soils. Its value was recognized by the ancient Greeks, who brought it from its native Middle East to Greece and Italy, and by the Arabs, who disseminated it along the North African coast and north into Spain and Portugal. It was spread in recent times to other Mediterranean-like regions such as California, Arizona, Mexico, Chile and Argentina by Spaniards, to parts of Australia by Mediterranean emigrants and to South Africa and India by the English.

The carob tree is an important component of the Mediterranean vegetation and its cultivation in marginal and prevailing calcareous soils of the Mediterranean region is important environmentally and economically. Traditionally, grafted carob trees have been interplanted with olives, grapes, almonds and barley in low- intensity farming systems in most producing countries. Carob pods with their sugary pulp are a staple in the diet of farm animals and are eaten by children as snacks or by people in times of famine. However, currently the main interest is seed

production for gum extraction. Kibbled pods have been shipped from producing countries to all over Europe. Because of low orchard management requirements the carob tree is suitable for part-time farming and shows potential for planting insemi-arid Mediterranean or subtropical regions. The trees are also useful as ornamentals and for landscaping, windbreaks and afforestation. Cattle can browseon leaves and the wood is suitable for fuel (batlle,tous)1997

Cultiveers:

Most of the roughly 50 known cultivars are of unknown :

'Casuda'-a very old cultivar from Spain

'Clifford'-seedling street tree in Riverside

'Tantillo'-from Sicily

'Tylliria'-from Cyprus

'Amele'-an old commercial variety from Italy

'Sfax'-from Menzel bou Zelfa (batlle and tous 1990)

Botanical description:

The carob tree grows as a sclerophyllous evergreen shrub or tree up to 10 m high, with a broad semispherical crown and a thick trunk. Leaves are 10-20 cm long, alternate, pinnate, with or without a terminal leaflet. Leaflets are 3-7 cm long, ovate to elliptic, in 4-10 normally opposite pairs, coriaceous, dark green and shiny above, pale green beneath and finely veined with margins slightly ondulate, and tiny stipules. The leaves are sclerophyllous and have a very thick single-layered upper epidermis, the cells of which contain phenolic compounds in the large vacuoles, and stomata are present only in the lower epidermis and arranged in clusters Relevant parts of the plant are shown in Figure 2. Carob does not shed its leaves in the autumn but only in July every second year, and it only partially renews leaves in spring (April and May) (Diamantoglou and Mitrakos 1981)

The carob is a dioecious species with some hermaphroditic forms; thus male, female and hermaphrodite flowers are generally borne on different trees.

Unisexual and bisexual flowers are rare in the inflorescence. The flowers are initially bisexual, but usually one sex is suppressed during late development of functionally male or female flowers dioecy is not common among Leguminosae. In evolutionary terms, unisexuality is generally regarded as a derived character from bisexual ancestral state Flowers are small and numerous, 6-12 mm long, spirally arranged along the inflorescence axis in catkin-like racemes borne on spurs from old wood and even on the trunk (cauliflory). Flowers are green-tinted red. Flowers show pentamerous symmetry with calyx but not corolla placed on a short pedicel. The calyx is disc-shaped, reddish-green and bears nectaries. Female flowers consist of a pistil (6-8.5mm) on a disk and rudimentary stamens, surrounded by 5 hairy sepals. The ovary is bent, consisting of two carpels 5-7 mm long and containing several ovules. The stigma has 2 lobes. Male flowers consist of a nectarial disk with 5 stamens with delicate filaments surrounded by hairy sepals. In the centre of the disk there is arudimentary pistil. Hermaphrodite flowers are a combination of both types, containing a pistil The fruit is an indehiscent pod, elongated, compressed, straight or curved, thickened at the sutures, 10-30 cm long(haseelberg, C. von. 1996), 1.5-3.5 cm wide and about 1 cm thick with blunt or subacute apex. Pods are brown with a wrinkled surface and are leathery when ripe. The pulp comprises an outer leathery layer (pericarp) and softer inner region (mesocarp).. They are very hard and numerous, compressed ovate-oblong, 8-10 mm long, 7-8 mm wide and 3-5 mm thick; the testa is hard and smooth, glossy brown, the hilum minute. (Batlle,tous)1997

Ecology:

The carob is a long-lived evergreen and thermophilous tree thriving in habitats with mild Mediterranean climates. It grows well in warm temperate and subtropical areas, and tolerates hot and humid coastal areas. Carob and orange trees have similar temperature requirements but carob tolerates poorer soils and needs much less water. The carob tree is more tender than the olive. For resistance to dry environments it is surpassed only by pistachio (Evreinoff 1955). It is also a xerophytic species well adaptated to the ecological conditions of the Mediterranean region, by virtue of its efficient hydric regulation by stomatic adjustment and its foliar structure and anatomy (Catarino et al. 1981). Leaf wax synthesis increases in dry conditions reducing cuticular permeability and thus protecting the plant from excess transpiration (Baker and Procopiu 1980). L. var. sylvestris, forms one of the most characteristic associations of the lowest zone of the Mediterranean vegetation and thus is considered to be a climax community (Oleo-Ceratonion).

Like other Mediterranean species with long-lived leaves and an extended flowering period, mechanisms have evolved that optimize water, carbon and nitrogen use for reproduction (Correia and Martins-Louçâo 1995). Several studies have shown that carob trees can maintain stomata open and high leaf water content even under low soil water availability (Nunes et al. 1989). This is allowed by a sharpreduction of leaf water potential in response to small water losses (Lo Gullo andSalleo 1988).

The two main growing flushes are in spring and autumn as in most Mediterranean trees. Vegetative growth slows below 10°C. Thus, it seems that this species enters some kind of 'light' dormancy, at least in most cool latitudes.

However in some very warm places and under favourable conditions, carob grows without becoming dormant either in winter or summer (Liphschitz and Lev-Yadun1988). The cambium can be active throughout most of the year (Fahn 1953), or all year with low rates of activity in January1977). Investigations on the annual rhythm of cambial activity in Italy by Scaramuzzi et al(1971) showed that cambium is active from February to the end of September and inactive during winter months owing to low temperatures.

The rooting habit of carob is similar to pistachio; its extensive root system penetrates the soil deeply. Carob develops roots under stressful conditions to explore deeper soil layers where water may be available (Christodoulakis 1992). It can thus survive long periods of drought. In addition, Nunes et al (1989) reportedthat carob leaves can maintain turgor under situations of soil drought, using different strategies according to the season.

Although the carob tree is a legume, like most Caesalpinioideae it does not nodulate and thus is unable to fix nitrogen (Martins-Louçâo and Rodríguez- Barrueco 1982; Martins-Louçâo 1985). Arbuscular mycorrhizal (AM) fungi have been shown to colonize carob roots, but no ectomycorrhizal association was found (Martins-Louçâo et al. 1996). The colonization by AM can increase nitrogen uptake Promoting the conservation and use of underutilized and neglected crops. 17. 49 by the plant. Since carobs often grow on nutrient-deficient soils lacking nitrogen and phosphorus in particular, AM fungi can improve nutrition.

Climate requirements:

Areas suitable for carob should have a subtropical Mediterranean climate with cool,not cold, winters, mild to warm springs, and warm to hot dry summers. These Mediterranean-like areas range from approximately 30° to 45° in northern latitudes (Mediterranean basin, California and Arizona) and between 30° and 40° in southern latitudes (Australia, South Africa and Chile).

Adult trees require no winter chilling; they can be damaged when temperatures fall below -4°C and can only withstand winter temperatures of not lower than -7°C.

However, trees can withstand summer temperatures of 40°C and hot dry winds.

From 5000 to 6000 hours above 9°C are needed for pods to ripen. Strong winds can break adult tree branches and detach pods. Wind can also damage young trees (Tous and Batlle 1990). Autumn rains can interfere with pollination and affect fruit set. High humidity in spring promotes Oidium infection on both leaves and pods.

Soil requirements:

Carob trees can adapt to a wide range of soil types from poor sandy soils and rocky hillsides to deep soils, but they cannot withstand waterlogging although the root system is usually deep. In areas with shallow rocky soils, tree size and productivity are reduced. The best soils are sandy well-drained loams but calcareous soils with high lime content are also suitable. Carob also appears to tolerate salinity well (Rebour 1971). Winer (1980) reported tolerance to a soil salt content of up to 3% NaCl.

Water requirements:

Carob, as a xerophytes, can survive dry climates without irrigation and is well adapted to dry environments with annual average rainfall between 250 and 500 mm per year .It has developed some drought-resistance mechanisms.

As mentioned in the Agronomy section. Although drought resistant, carob trees do not bear commercial crops unless they receive at least 500-550 mm per year .but 350 mm of annual rainfall are considered enough for fruit set.(tous and battle 1990

Agronomy:

Seed germination:

The seeds used for sowing should be completely ripe and extracted from pods of the last harvest. Sowing should be done early in the spring, about March-April.

Before sowing, the light, empty or wormy seed should be removed; this can be done by soaking in water when most of the faulty seeds float on the surface and can be easily removed. Although carob seeds have remained viable for as long as 5 years stored dry at low temperatures in sealed containers Goor and Barney 1968; Hong ..it is advisable to use seeds from the current season. Seeds are presumably viable after passing through an animal's digestive tract.

Carob seeds germinate easily, but as the coat is very hard they require scarification with acid or hot water treatment. Germination can be hastened by treating them with tap water, boiling water, sulphuric acid .

Carob seeds do not need to be kept in a cold store to break dormancy. At IRTA-Mas Bové good results were obtained using fresh seed sown in March-April, with any of the following methods or combinations of methods:

- Soaking in tap water at room temperature for 15 days.
- Soaking in boiling water, stirring briskly for 10 minutes and then immersion in cold water for 24 hours.
- Soaking in concentrated sulphuric acid for 1 hour and then rinsing with tap water to prevent complete digestion of the seed coat.
- Soaking in gibberellic acid (25 ppm) for 24 hours.

Frutos (1988 scarified carob seeds with sulphuric acid solutions (10, 20, 30, 40 and 80%) for 30 minutes and then soaked them in water for 24 hours and placed them in Petri dishes at 23°C; he obtained the best germination (99.1%) using sulphuric acid at 80%. However, he observed no effects on seed germination after treatment with GA3 at 50, 100, 200 and 400 mg/L for 24 hours. After treatment and washing, seeds are usually soaked for another 1-2 hours before planting and are sometimes surface-sterilized with dilute bleach. After soaking, water is drained away and the seeds are sown either into polyethylene trays on greenhouse benches and kept at 20-30°C or directly into tall plastic pots (12-15 cm diameter and 35-40 cm deep) placed outside under shading.(tous and battle1990

Propagation:

Carob rootstocks are raised from open-pollinated seeds and these seedling rootstocks vary widely in vigour, habit and cold resistance. No rootstock trials have been carried out and no rootstock selections are available. It is essential that rootstocks produce a well-developed rooting system. The seedling stocks should be budded 1 year after germination, in the nursery, or 2 years from germination, after planting in the orchard. Vegetative propagation by cuttings is not yet commercially available(tous and battle. Young seedlings are very sensitive to frost damage and thus in frosty places they should be protected. periodically sifting out those that have swollen to 3 times normal size. Germination rate may be only 25%. The swollen seeds are traditionally planted in flats and when they produce the second set of leaves they are transferred to small pots. When 12 in (30 cm) tall, they are transplanted to large containers or nursery rows. A recently developed technique is to plant the seeds in 2 halves of clay drainpipes bound together or in plastic tubes packed in deep wooden boxes to accommodate the long taproot. In perhaps a year, the tubes are split and the seedlings are planted in the field in holes made with a post-hole digger. Budding is done when the stem is at least 3/8 in (1 cm) thick.

Soil maintenance:

soil maintenance in carob orchards has traditionally been carried out by tilling weeds to reduce evapotranspiration and improve water penetration. It is advisable to till the soil only to 15-20 cm depth, to prevent disrupting the shallow and active root system as this soil zone is generally the more fertile and better aired. Shallow tillage using a harrow or a cultivator is effective. Farmers usually till three times during the year, the first time in autumn before the rainy season starts, the second in spring and the third when the pods starts to ripen in early summer. (Tous and Batlle1990).

In some orchards weed control. The most commonly used chemicals have been simazine (pre-emergent, residual), paraquat, ammonium glyphosinate and glyphosate (postemergent). Itis advisable to avoid the application of residual herbicides before the 4th or 5thyear. Weed control is especially important in young plantations, since heavy weed competition for water and nutrients can significantly reduce tree vigour and productivity.

Fertilization:

Traditionally, carob orchards have hardly been fertilized. Its always been considered extremely adaptable to very poor soils and only some manure, when locally available, has been applied. However, in recent years, the revaluationof the crop has led some farmers to apply various types of fertilizer, either mineralor organic (Martins-Louçâo 1993).

Irrigation:

In the Mediterranean region, where water resources are scarce, irrigation is reserved for the more profitable horticultural crops. Therefore, the carob tree is planted in dry land. However, the availability of water is a requirement for good production. In this drought-resistant species the supply of water should be considered as occasional irrigation and within certain limits of dose and time of the year Tous and Batlle (1990 .researches gave a positive effect of irrigation on fruit production. Some experiments on young trees also resulted in a positive effect of irrigation on pod production. (Esbenshade and Wilson 1986).

Harvesting:

Harvesting is usually carried out at the end of summer or the beginning of autumn depending on cultivar and region. Harvesting can be manual or mechanical. In Mediterranean countries, carob groves are mainly hand-harvested by knocking down the pods with the help of long bamboo poles or wooden sticks and collecting them on fibre nets which are laid out under the trees. This operation needs careful handling since at this time of the year the carobs are in full bloom. The striking action of the poles can damage flowers and the next crop might be partially destroyed. This task constitutes the most significant part of the total cost of cultivation since it requires much hand labour, being currently about 30-35% of the total production costs (Orphanos 1980; Tous 1995 . In Spanish orchards the quantity of pods manually harvested, in average crop years, varies between 250 and 280 kg/day per worker . Mechanical harvesting using trunk or branch shakers has not been practised in most producing countries, mainly because of the small size of most orchards. . To reduce harvesting cost, pods of a given cultivar should all be harvested at one time.

Fruit ripeness, and therefore its optimal harvesting time, is indicated by the complete darkening of the pedicel just prior to natural detachment from the branch.

This is a reliable sign that pods are ripe and have reached their full sugar content. Sometimes pod drop is hastened by the wind. Carobs should be harvested when they have 12-18% water content. After harvesting, carobs are either delivered to the processor or stored under shelter. Moisture will gradually decrease during the subsequent months of storage.

Post harvest:

carob pods have a moisture content of 10–20% and should be dried down to a moisture content of 8% so the pods do not rot. Further processing separates the kernels (seeds) from the pulp. This process is called kibbling and results in seeds and pieces of carob pods (kibbles). Processing of the pulp includes grinding for animal feed production or roasting and milling for human food industry. The seeds have to be peeled which happens with acid or through roasting. Then the endosperm and the embryo are separated for the different uses.

Nutritional value:

It contains 60% protein and a large quantity of cholesterol-free oils. The carob fruits contain vitamins A, B, B, B, B, and D) and important metal elements such as potassium, calcium, iron, phosphorus, manganese, barium, copper, nickel, magnesium, etc., and oxalic acid, which inhibits the absorption of calcium and other mineral elements, Facilitate the process of intestinal absorption of these minerals and benefit greatly, and complete G. Fruits are not caused by symptoms of allergies(web site)

Pests and diseases:

The most damaging insect is the moth, *Myelois ceratoniae* scale insects: Aspidiotus ceratoniae, Lecanium sp., Lepidosaphes sp. and the red scale, Aonidiella aurantii. A beetle, Cerambyx velutinus, may bore holes in the trunk , Rats

Pest Control:

1. Seize infected branches and burn them.

2. Interest in activating the cycle of biological enemies by not spraying any 2 compounds during periods of activity and the selection of less toxic pesticides on these vital enemies.

Chemical control can be used in case of severe injury using:

1. Phosphoric compounds such as ACTELLIC® and Sumithion® at 150 cm / 100 liters of water.
2. Mineral oils such as Kz, Super Royal or Super Masona at a rate of 1.5%

Diseases:

1. Root root diseases: Seedlings and carob trees are infected with many diseases caused by pathogenic microorganisms such as the disease of wilt caused by the infection of several fungi, such as (Fu-Sarium Oxysporum), which causes fusarium or fungus (Verti-cilium dahlia) Fertilisium.
2. Diseases of mold root: which arise as a result of the incidence of many fungi soil such as:

- (Fusarium spp)
- (Fusarium solani)
- (Rhizoctonia solani)

3. Diseases of the root and fruits: The most important: (Albayq Aldqqiqi) - (Papillary ulceration).
4. Diseases of the emergence of the leaves: (Cyrxpory) - (dead spots on the leaves)(web site)

Pharmaceutical uses:

- Useful for colic.
- Repellent and diuretic.

- Used for dental and gums.
- Calms the excess movement of the bowel muscles and makes the stools of -the stool half dry and reduces the loss of salts and imbalance in the body -also advised to add carob extract to infant formula to regulate the process of output and reduce the incidence of diarrhea in them. (web site)
- Irritable bowel syndrome is very effective as the carob drink has great -benefit in preserving the freshness of the body and protecting it from dryness. It reduces the body's loss of fluids and thus maintains the balance of -salt content in the body.(web site)
- Useful in the absorption of some toxins and harmful secretions in the stomach.
- Carob is beneficial for diabetics if mixing carob powder with thermos, ring and laxatives.
- Lowers the proportion of diabetes in the blood, and the proportion of cholesterol(web site)

Feasibility:

The carob tree is a low-yielding but long-lasting tree and because of other environmental benefits in the face of wind, hurricanes and soil erosion. Therefore, the area of one hectare does not generate profits exceeding US $ 400 per year**. (**web site)

Kharoub Caldbs, the profits may reach up to $ 600 so the carob tree is a secondary yield crop and grown International prices of carob fruits range from US $ 1000 to US $ 7000 per ton. Pricesvary by quality, quality and quantity of supply and demand (jan stivan).

CHAPTER THREE

MATERIAL AND METHOD

The study was about breaking the dormancy and germination of the seeds of the carob plant. The study site was in Khartoum, Shambat at Sudan university for science and technology Faculty of Agricultural Studies Nursery of medicinal plants seed source was from south Kordufan state .

Material:

- Bags
- Clay
- Sulfuric acid
- Scalpel
- Colander

Method:

the study was carried to determine the germination percentage of the five treatments to brooking dormany for 90 seeds by use: soaking in water, scarping, sulpheric acid ,hot water and cold and hot water .. seed was tested by random sample of 15 seed in one treatment with 3 replication … 15 seeds were soaking in water for 24 hours, and planted in bags in nursery for testing.

15seeds were soaked in sulphric acid for 15 minutes ,washed then tested for germination in bages in nursery for 15 minitues.

15 seeds soaking in boiling water for 2 minutes and planted in nursery.

15 seeds soaked in boillling water for 2 minitues then in ferrzing water then it took to the nursery .the other 15 seeds were scarshed and took to the nursery the last 15seeds were control.

CHAPTER FOUR

RESULTS

The experiment was conducted for 5 weeks and weekly readings were taken for each laboratory. The germination rate was calculated every week and the results were:

*In the first week there was no germination

Table 1. Germination rate of seeds in the second week of the three replicates:

Treatment	Replicates			Germination	Main
H2SO4	40	20	0	60%	20
Scratching	0	25	0	25%	8.3
Hot water	0	0	0	0%	0
Hot and cold water	0	0	0	0%	0
Soaking	20	20	0	40%	13.3
Control	0	0	0	10%	3.3

Table 2. Germination rate of seeds in the third week of the three replicates:

Treatment	Replicates			Germination rate	Main
H2SO4	40	60	0	100%	33.3
Scratching	0	20	20	40%	13.3
Hot water	40	0	0	0%	0
Hot and cold water	0	0	0	0%	0
Soaking	40	40	0	0%	0
Control	0	0	20	20%	6.6

Table 3. Germination rate of seeds in 4th week of the three replicates:

Treatment	Replicates			Treatment	Main
H2SO4	40	80	20	140%	46.6
Scratching	0	20	20	40%	13.3
Hot water	40	0	0	40%	13.3
Hot and cold water	0	0	0	0%	0
Soaking	40	40	0	80%	26.6
Control	0	20	20	40%	13.3

Table 4. Germination rate of seeds in the 5th week of the three replicates:

Germination rate	Replicates			Treatment	Main
H2SO4	40	100	20	160%	53.3
Scratching	0	20	20	40%	13.3
Hot water	40	0	0	40%	13.3
Hot and cold water	0	0	0	0%	0
Soaking	40	40	0	80%	26.6
control	0	40	20	60%	20

Germination rate for all weeks=22%

Table 5. Speed of germination for all weeks:

1 week	0
2week	28%
3week	21%
4week	26%
5week	31%

Speed germination for all weeks=30%

Statistical method:

statistical analysis was carried using Analysis of random sectors was done determine the effect of soaking in water, scratching, hot water, hot and cold water and control on germination percentage .

S.O.V	Df	SS	MS	Calculated F	Tables F 1%	5%
Total	17	246.5	-	-	-	-
Treatment	5	89.5	18	1.44	5.64	3.33
Block	2	32.3	16	1.28	7.56	4.10
Error	10	124.7	12.5	-	-	-

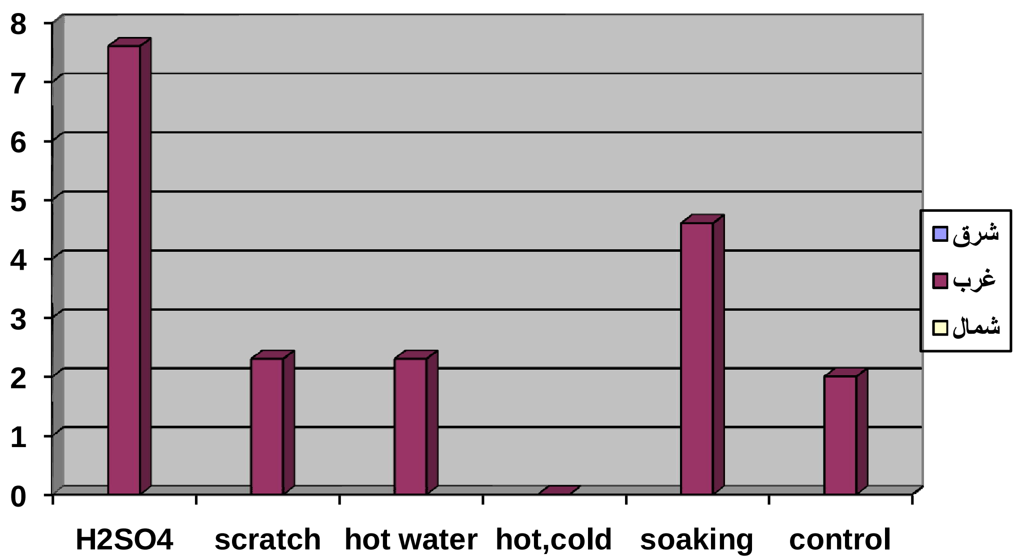

Figure 1. Show main of the treatments

A=Sulfuric acid gave the highest percentage of germination b=Soakig in water for 24 hours

Discussion:

The results of our study showed that the treatment of seeds with acid led to an increase in the germination rates of its ability to break the hardness of the packaging faster than other treatments. Our results showed that there were differences between the types studied in breaking the seed casings were very small in hot water treatment and scratching and were not treated with hot water and cold.

Recommendations:

1. To break the hardness of the seed casings, I recommend the use of diluted sulfuric acid because of the high results of germination in this study.

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APPENDIX

The mean for treatments:

Treatment	**Mean**
H_2SO_4	7.6
Scratching	2.3
Hot water	2.3
Hot and cold water	0
Soaking	4.6
control	2