"FIRST INTERNATIONAL CONFERENCE ON SCIENCE, INDUSTRY AND TRADE OF COTTON, GORGAN, IRAN, 2-4 OCTOBER 2012"

Workshop on the subject of "Seed Science and Technology" with special reference to cotton seed production and quality.

Presentation by E. M. Khah, Professor in "Seed production & Plant propagation Technology", Laboratory of Genetic Plant Breeding, School of Agriculture, University of Thessaly, Volos, Greece.

The workshop will be divided in three sections: 1 **Seed Production and Handling 2.Factors affecting the quality of cotton seed production 3. Evaluating Cotton Seed Quality.**

Duration of each section will be one hour and at the end of the lectures, one hour will be given for questions and discussion (in total 4 hours). The presentation will be in Power point
Let's consider each of these sections in turn:

1 **Seed Production and Handling**
Cotton seed production is a major industry in the world. The complete process that one goes through to produce seeds has developed into a science, but some of it still remains art (as do other aspects of horticulture). The processes of cotton seed production and handling will be study in details with special reference to the two major countries of Europe, Greece and Spain.
i. Genetic selection: to select the varieties with the desirable characteristics and to explain the Genetic variation control in seed production:
- Phenotype selection: phenotype of individual seed is a good indicator of the phenotype of the offspring that will be produced. The relation and the interaction between Genotype and Environment (ecotypes) will be discussed.
- Use of local seed: Use of seed origin or provenances of Natural populations evolve over long period of time to become adapted to that area (ecotypes). Emphasis will be given to the use of **seed collection zones** even though the actual location may be quite far from the eventual site of planting.
- Pure stands: Seed of different cultivars or species causes variability and decreased yields. Some Seeds are maintained to maximize superior genetics to different diseases.
- Maintaining genetic identity: how does one maintain genetic identity of the plants that are used to produce seeds? What conditions are required ?
1. ***Isolation,*** a). Prevents contamination by cross-pollination when pollination happens by wind or insects. May need up to 2 miles isolation depending on the plant. The recommended distance for cotton seed production is 50 meters. b). Prevents mechanical mixing of the seeds.
2 . ***Rouging:*** Physically removing off types that are identified visually.

3. *Testing for trueness-to-type:* is necessary when:
a). Carried out with **seedling progeny tests**.
b). Planting representative seeds in a test plot.
c). Make sure that there has been no change in genotype over time. Changes can occur from selection pressure by rouging which could change the frequency of certain genes over time.
4. *Controlling generation sequence of new cultivars, line:* limit and generations for production from original seed- the general scheme of cotton seed production is:
Breeder's seed -----> Foundation Seed ------> Registered seed ---------->Certified seed

II. Seed production: involves growing the crops in specific areas or identifying populations in the wild or local existence.

a). Seed collection: seeds must be collected (harvested) at the proper stage, which is usually after the seed has reached physiological maturity. Thus, it is critical to know the biological seed development of the different species, dealt with. Physiological maturity is the stage when there is no **further increase in dry weight** in the seed. This is not as easy as it seems because one has to be aware of collecting seeds too early or too late especially if the seed naturally dehisces at maturity. Sometimes seeds are collected under difficult situations such as adverse environmental conditions, i.e. raining at harvest time, high and low moisture content as well as temperature in air or soil. In these cases harvested seeds will be already deteriorated and will be in low vigour in quality.

b). Seed delinting and cleaning (may be called seed conditioning in the industry) during which the lint is removed from the seed, cleaned and separated from non-seed materials and weed seeds

c). Seed treatment (seed coating or pelleting) which is necessary for seed disinfection for safe maintaining it in the storage. Also, it enhances emergence in the soil. In this section, the latest methods and technology which are used by some seed production companies will be introduced.

d). Packaging and storage which are prerequisites to sale and marketing. Also, will be explained basic knowledge which is necessary for long saving quality of seed until the sowing stage. Seeds are usually dried for storage but sometimes drying is necessary in most seeds in order to maintain viability and avoid fungal and bacterial infection

2). Factors affecting the quality of cotton seed production

I. Genetic factors

Plant breeding is widely recognized as the major single contributor to the dramatic increase in agricultural yields observed over the last century. The seed is the delivery system for the scientific advances and technological innovations that have been achieved through plant breeding. Genetic arises from breeding or selection of elite individuals in the wild or local species which are often subjected to intense breeding efforts.

ii. Environmental factors

Once the specific plant has been identified and selected, special techniques are required to assure that the seed harvested from the individual plants continues to produce the desired genotypes. Such procedures usually require large acreages especially for crop such as cotton and cereals. Since many seed production areas are not irrigated, low rainfall during plant growth or imposed to high amounts of rain during harvest time can be devastating and deteriorating. Therefore, the requirements for sound seed production such as selected climatic and geographical seed collection zones, labor experts, machinery equipments will be discussed.

3. Evaluating cotton seed quality:

i. Seed testing is required by state laws. The producer is required to determine the purity, germination percentage, and must be certified to be disease-free.

The standard germination test.

The classical and standard germination tests, in the framework of quality assurance facilitate the equivalence of seeds evaluation.

Seeds put in a rolled paper towel moistened with water at the proportion of 2.5 times the dry substratum weight and germinate at 25±2 °C. Seeds are counted at 4 and 12 days after seedling emerged as prescribed by the ISTA rules (ISTA, 1985). The results were expressed as percentage of normal seedlings for each lot.

Seed vigour evaluation

ISTA germination test measures vigour of samples, but imprecisely All vigour tests are based on ageing and magnify differences between samples. Almost all vigour tests that are in use or proposed can be explained in terms of seed ageing and its consequences. Experimental evidence will be presented to support this hypothesis. The consequences of ageing, including electrolyte leakage of seed into soak water and slower physiological germination, form the basis of many vigour tests. These tests differentiate the field emergence as well as the storage potential of seed lots that have similar and acceptable high levels of standard germination. The ageing hypothesis can be extended by interpreting differences in rate of germination as differences in the mean lag period between water imbibition and radicle protrusion. This proposition will be used to explain some stress tests for cotton and some effects of seed priming, as will be mentioned below:

The cold test is in the same way as the standard germination test, yet at 18 °C.

Cool-Warm Vigour Index is determined when cool germination and standard germination numbers were added together; high quality seed will have a high vigour index (ranging from high to low vigour level, i.e. 160 to 120 respectively).

Rate of germination is the rate of physiological germination, which is the most accurate indicator of age after Ki value (Ki, is the unique quality value for each seed lot and it's value is determined using accelerating tests).

The tetrazolium test is used when seeds (50 of 4 replicates) soaked in deionized water for 18 hours at room temperature. The seed coat and membranes of each seed are carefully removed and the naked seeds incubated at 40 °C in a 1% solution of 2, 3 triphenyl-tetrazolium chloride in a phosphate buffer (pH 6.5-7.0) for 1 hour. Seeds are recorded as sound, viable or unviable based on the degree of staining (Moor, 1985).

Free fatty Acid analysis is obtained from each sample of 200 g seeds and is used for the determination of FFA so that cottonseed oil will be extracted by solvent extraction using diethyether as a solvent accordingly. The obtained amount oil is filtered and used for the determination of Free Fatty Acid % and peroxide value (AOCS, 1990).

Some more types of vigour tests in use:

- ***Ageing based tests***
- ***Seedling growth tests***
- ***Conductivity of seed soak water***
- ***Computer vision of physiological germination without seedlings***
- ***Oxygen uptake, ethanol***
- ***Biochemical /molecular methods on metabolic repair***

ii. Seed treatment is used to enhance potential for germination or facilitate mechanical sowing. Seed treatments currently in use throughout the industry include chemical and physical treatments against pathogens, seed coating, priming, and pro germination. We will discuss these treatments later in the course.

iii. Seed storage depends on the kind of seed. Orthodox seeds remain viable for up to 15 years. The proper storage is essential for the seeds. Low humidity and low temperatures. Long-lived seeds with hard coats, impermeable to water, may still germinate after 100 - 200 years or longer.

References

A.O.C.S, 1990. Offical methods and recommended practices of the American oil chemists' society, 4th edition, Champain. Illinos.

ISTA, 1985. International Rules for Seed Testing. Seed Science and Technology,13, 299-355.

Khah, E.M., Passam, H.C., 1994. Sensitivity of seed of cotton cv. Zeta-2 to damage during acid-Delinting. Plant Varieties and seeds, 7, 51-57.
Moore, R.P., 1985. Handbook on tetrazolium testing. International Seed Testing Assoc., Zurich, 99p.
Zaxos, D., Kostoula, S., Khah, E.M., Mavromatis, A., Chachalis, D., Sakellariou, M., 2012. "Evaluation of seed cotton (Gossypium hirsutum L.) production and quality in relation to the different irrigation levels and two row spacings".International Journal of Plant Production (2012) 6(1): 129-148 135