4-1-1988

An Overview of Quality Peanut Seed Production

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AN OVERVIEW OF QUALITY PEANUT SEED PRODUCTION

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Peanut production in the United States is concentrated in three major geographical areas. The southwest area usually has about 375,000 acres devoted to peanuts, the southeast about 850,000 acres, and the Virginia-Carolina area about 200,000 acres. The southeast area produces about 70% of the tonnage in this country each year. Peanuts are used in many ways with peanut butter being the major product. About 70% of the southeast crop is consumed as peanut butter. Other major uses for peanuts are roasted nuts and other forms of snack food. Approximately 10% of the crop is processed into peanut oil for cooking.

Peanut Marketing

Peanuts have grown in importance since the mid-1940s. The boll weevil gave major impetus to peanut production as this pest encroached into the southeastern United States. As the boll weevil began to take its toll with cotton, more people began looking to other crops for diversification. As peanut production became more prevalent, it was placed under governmental control programs resulting in acreage allotments. Acreage allotments remained in effect until the late 1970s when they were replaced with poundage allotments. At the present time, the poundage allotments are referred to as quota pounds. Any peanuts produced on farms that are not covered by the quota pounds are referred to as additional peanuts. The marketing system is set up such that essentially all additional peanuts must be placed in the export market and quota peanuts are used domestically.

Peanuts, at the time of sale, are graded by inspectors of the Federal-State Inspection Service. The price that the grower receives for peanuts is based on grade factors and whether the peanuts are quota or additional. Both classifications are under USDA-ASCS price support systems, however, there are dramatic differences in the price factors of the classifications. Additional peanuts are priced considerably less than quota.

This two-price system has led to contracting of peanut production by growers to various buying points. This has led to some

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variation in price due to competition with some companies willing to pay more than price support levels for each poundage classification.

Varietal Development

Peanuts are unique compared with other agronomic crops in that the majority of the varietal development work is being conducted in University breeding programs. These programs are currently in place and productive in North Carolina, Georgia, Florida, Texas, Oklahoma, and New Mexico. Peanut yields have increased dramatically during the last 15 years. This yield increase may be attributed to many factors included in "total package" approaches to peanut production, however, the genetic potential for high yields are now inherent in the more accepted varieties.

Peanut Seed Production

Successful peanut seed production entails all of the production and management requisites of successful commercial production plus factors directed toward development and maintenance of seed quality. This is generally applicable to seed production of most agronomic crops. With this in mind, we will discuss peanut production with emphasis on quality seed production. Seed certification should serve as a basic quality control factor in peanut seed production. Peanuts are relatively expensive to produce and seed is one of the major production costs. The seeding rate is approximately 100 pounds per acre and certified seed cost approximately 75 cents per pound. During recent years, certified peanut seed have been planted on at least 90% of the peanut production acreage. One primary reason for this is the growers' demand for high quality seed and difficulties that growers encounter in trying to "save" seed. Storage, shelling, and quality problems generally discourage growers from using their crop as seed.

Quality peanut seed production begins with a grower selecting land and seed. Foundation or registered seed must be planted to produce certified seed. A good rotational program is essential to reduce disease and volunteer plant problems. Peanuts can be grown in soils ranging from light sands to heavy clays, however, the heavier soils tend to accentuate harvesting losses since the peanuts must be lifted from the soil at harvest. Sandy loam soils are best suited for peanut production.

Peanut seed are generally produced by growers under contract to commercial companies that buy, store, and condition the seed. Essentially, all of this production is under seed certification. Companies generally offer a premium above commercial market price for

peanuts that qualify for seed. The company applies to the certification agency for field inspection and certification. During field inspection, the inspector is concerned with: (1) varietal purity, (2) isolation distance, and (3) noxious weeds in the field. Nutgrass is the primary noxious weed of concern in peanut seed production. Nutgrass tubers are difficult to remove during normal conditioning procedures.

Nutritional Requirements

High quality peanut seed production requires suitable pH and fertility levels. In addition, adequate levels of available calcium and boron must be present. Calcium must be available in the pegging zone of peanut plants. It is not translocated through the plant's vascular system but must be absorbed from the soil through the shell to the peanut. Calcium deficiencies result in dark plumules in the seed, empty hulls, and/or plants that stay green, continually flower and produce pegs but limited fruit development. Lime may supply adequate available calcium, however, for quality seed production the addition of calcium in the form of calcium sulfate (landplaster) is strongly recommended. Calcium content of the seed necessary for adequate germination varies with peanut types and/or varieties. As a general rule in runner peanuts the calcium content should be at least 420 ppm so as not to be a limiting factor in germination or seed quality.

Boron is an important minor element. Boron deficiency results in a condition known as "hollow heart" in peanuts. Generally, boron applied at the rate of 1 pound per acre will prevent this condition.

Insect Control

Since peanuts produce seed underground, special emphasis must be given to insects such as burrowing bugs, lesser cornstalk borers, cutworms, and southern corn root worms. Failure to control these insects can lead to reduced yield and seed quality. Generally, these insects are controlled by the application of granular insecticides during the growing season.

Foliage insects such as thrips and aphids can inhibit production and are vectors of some virus diseases that may be transmitted either in or on the seed. The application of granular insecticides at planting and/or insecticidal sprays are acceptable control methods.

Peanut Diseases

Peanut diseases occur throughout the growing season and affect both aerial and subterranean parts of the plant. Disease and nematode resistance and/or tolerance receives major emphasis in many breeding programs. The more prevalent diseases affect yield and seed quality by promoting non-uniform or pathogen infected seed. Major diseases are caused by fungi, bacteria, and viruses. Several types of nematodes affect peanuts. Methods of disease control include crop rotation, deep plowing, extensive fungicidal spray programs, and nematicides.

Moisture Requirements

Of course, adequate moisture is essential for profitable peanut production. From the viewpoint of seed production, moisture is also important for adequate pod fill and calcium uptake. Moisture stress during seed development generally results in reduced seed size and calcium content as well as reduced yield. During recent years, we have had some reduction in rainfall, but more importantly, uneven rainfall distribution during the growing season. Since peanuts are indeterminate, a major problem associated with moisture stress is the range of immature to mature peanuts on the plants at harvest. Moisture stressed plants that have a high percentage of high moisture immature seed are difficult to dry uniformly. The immature seed usually shrivel, retain excessive moisture, and are termed "raisins." They are not separated during harvesting due to weight and usually cause problems in storage by inducing mold growth and problems with moisture and temperature equilibration within the seed mass.

Large seeded Virginia-type peanuts are even more prone to quality problems when grown under moisture stress conditions than smaller seeded runner types. Germination and overall quality diminishes more rapidly probably due to overall reduced seed development and lack of adequate calcium uptake.

Harvesting Peanut Seed

Peanuts, being indeterminate, offer a challenge in determining when to harvest. Recently, researchers in Georgia have developed a more sophisticated and reliable method of determining maturity. They discovered a relationship between color just under the outside layer of cells of the hull and maturity. By scraping or sandblasting away the outside layer of cells of the hull, they have concluded that the most profitable time to harvest can be predicted. A representative sample of the production field is essential for accurate results. As the peanuts mature, the layer of cells to be observed changes through progressive colors from white to black. Thus, the darker the color, the more mature the peanuts.

Harvest and drying are critical phases of successful peanut seed production. During harvest, peanuts are first lifted from the soil and dropped back onto the field in inverted windrows. Moisture content of the seed at this time is usually 40%. The peanuts are vulnerable to unfavorable weather conditions. Excessive rain or humidity is detrimental to not only seed quality, but yield as well. Ideally, peanuts are left in the windrows for two to three days and dry down to combinable moisture levels. For good seed quality, peanuts should be combined at moisture levels in the range of 18-22% and artificially dried. Temperature control during drying is essential. The temperature of the air being forced through the seed mass should not exceed 95 F. Higher temperatures can cause seed coat slippage and excessive seed splitting during subsequent conditioning. Peanut seed must be dried to 10% moisture for marketing and storage. They should not be artificially dried below 8% and will generally equilibrate with ambient conditions and remain about 7% moisture in storage if properly dried. Slow, uniform drying immediately after harvest is imperative for high quality peanut seed.

Peanut seed are among the most delicate of all agronomic crops to handle. The morphology of the seed dictate that they be handled gently or mechanical damage can become a problem. The radical portion of the embryonic axis protrudes beyond the cotyledons. This feature presents a major mechanical damage area especially if the seed are handled with force at either too low or too high moisture levels. During harvest and all phases of seed handling during conditioning, seed impact must be of primary concern. All equipment used during these operations must be adjusted properly and operated at speeds that will reduce impact forces on the seed.

Seed Storage

Peanut seed are stored in flat bottom warehouses generally equipped with fans to reduce temperature and condensation in the headspace. Most warehouses are also equipped with automatic insect foggers that emit an insecticide at timed intervals. Also, most warehouses are sealed and fumigated after being filled.

Peanut seed are generally stored in the bulk and in-shell in warehouses from harvest until January or February of the following year. Seed quality can generally be maintained more effectively with peanuts stored in-shell as opposed to shelled peanuts.

Seed Conditioning

In-shell peanuts are usually taken out of storage with a front-end loader. The first piece of equipment in the conditioning

line is a cleaner that removes foreign material and poor quality peanuts from the seed mass. This is generally followed by the sheller and a gravity table. The gravity table is used to separate small, unshelled peanuts from the good, shelled seed. The unshelled peanuts are elevated back to the sheller. Screens under the sheller also are used to remove splits and small peanuts from the seed. Color sorting equipment, commonly called electric eyes, are used extensively in peanut seed conditioning plants. The electric eyes can be adjusted to separate dark (nutgrass tubers) and light (splits and seed without seed coats) products from the seed. In most seed plants, peanut seed also pass over a continuous belt (picking table) and visually inspected. At this point, any material that the electric eyes missed can be removed by hand. The seed are then passed through sizing equipment to again remove splits and small inferior quality seed. The seed can now be boxed usually in 2,000 or 2,270 pound quantities for storage until treating and bagging. At the point of boxing, the seed may be divided into lots and preliminary samples can be obtained for quality testing. After preliminary quality evaluations have been made, the peanut seed are then treated with a fungicide, bagged, and tagged. At bagging, final germination samples are pulled as the seed are being made ready for sale.

Extreme caution must be observed in all phases of peanut seed handling, especially during the shelling process to reduce mechanical damage from impact. Seed are lowered into bins by spiral let-downs and mechanical devices must be installed in spouts to reduce the speed of the seed as they are conveyed within the conditioning equipment line. Due to excessive mechanical damage, augers are not used in either commercial peanut shelling or seed conditioning plants.

Peanut Seed Treatment

Peanut seed are routinely treated with fungicides at bagging. Peanut seed germinate and establish stands relatively slow. They are subjected to pathogens that cause seed decay and damping-off with regularity. This is especially true if environmental factors slow germination. The most prevalent pathogens are Rhizopus spp., Aspergillus niger, Phythium spp., Rhizoctonia spp., and Fusarium spp. These pathogens must be controlled for successful stand establishment. The fungicides that are currently being used are primarily broad-spectrum dust formulations.

Seed Quality Evaluation

Freshly harvested peanut seed generally exhibit some dormancy. The dormancy seems to be initiated once the seed are dried to storable levels. Dormancy can be broken in the seed laboratory by careful treatment with formulations of ethylene. Dormancy is generally not a

problem after storage through the winter. The alternation of temperatures coupled with time is thought to be the natural method of dormancy release.

Peanut seed quality is normally evaluated by the standard germination test. Some seedsmen will also employ the TZ test to help determine seed viability and the accelerated aging test as a vigor test. Bin samples are pulled for preliminary quality evaluation, however, the most effective and reliable samples can be obtained only after the peanut seed are shelled and assigned specific lot quantities. For this reason, most seedsmen do not shell and treat seed in the same operation. Since treating the seed takes the peanuts out of any commercial use other than seed, most seedsmen shell and store the seed until sufficient quality determinations can be made. Once sufficient quality data is accumulated, the seedsmen can more judiciously determine the lots to be either treated or sold as commercial edible peanuts.

Summary

Peanut seed production, in some aspects, is not unlike other agronomic crop seed production. The production of high quality seed of most all crops begins with the selection of land that qualifies and planting suitable stock seed for multiplication. From that point, careful attention to production, harvest, storage, and conditioning details that influence peanut seed quality is imperative. Peanut seed production is somewhat unique in that essentially all of the seed that enter commercial trade channels are certified. This has been a result of grower recognition of the value of superior planting seed, varietal development programs, and the complexity of problems growers encounter when using their crop as a source of seed.

Successful peanut seedsmen must focus their attention on factors that influence quality even before production in the field begins and follow through until delivery of the finished product.