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New Harvesting and Curing Techniques in the Production of Breeder's Seed Peanuts[1]

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ABSTRACT

A new method of harvesting and curing breeder's seed peanuts in Virginia was initiated that would 1) reduce the labor requirements, 2) maintain a high level of germination, 3) maintain varietal purity at 100%, and 4) reduce the risk of frost damage. Three possible harvesting and curing methods were studied. The traditional stackpole method satisfied the latter 3 objectives, but not the first. The windrow-combine method satisfied the first 2 objectives, but not the last 2. The direct harvesting method satisfied all four objectives. The experimental equipment and curing procedures for direct harvesting had been developed but not tested on a large scale for seed harvesting. This method has been used in Virginia to produce breeder's seed of 3 peanut varieties (Florigiant, VA 72R and VA 61R) during five years. Compared to the stackpole method, labor requirements have been reduced, satisfactory levels of germination and varietal purity have been obtained, and the risk of frost damage has been minimized.

Key Words: Peanuts, Groundnuts, *Arachis hypogaea* l., Breeding, Seed Production, Peanut Harvesting, Peanut Curing.

In 1973, a new method of harvesting and curing breeder seed peanuts to replace the stackpole method was sought in Virginia. Two new methods, windrow-combine and direct harvesting, were considered in addition to the stackpole method. There were four objectives: 1) reduction of the labor requirement, 2) maintainance of germination at a high level, 3) insurance of varietal purity at 100%, and 4) reduction of the risk of frost damage. The traditional stackpole method satisfied the latter three objectives, but not the first (1-7, 9). The windrow-combine method satisfied the first two objectives, but not the last two (1-4, 6-10, 12). The direct harvesting method satisfied all objectives (1, 5, 11, 12).

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This paper reports the results of the use of the direct harvesting method to harvest breeder's seed of three peanut varieties in Virginia during 1973-1977.

Materials and Methods

Three varieties (Florigiant, VA 72R and VA 61R) were grown in field plots of variable size from 1973 to 1977 based on expected demand for seed. Plants were grown in 91 cm (36 in.) rows, planted 1 seed per 10 cm of row. Standard peanut production practices were followed.

The direct harvester used consists of digging, picking and cleaning sections (11, 12). The digging components lift the plants from the soil and elevate them to the picking section. The peanuts are removed from the plants by three rotating drums as the plants move through the picking section in a naturally oriented position. The cleaning components include a paddle section for removing long branches, a suction fan to remove leaflets, fine roots and other small particles, and a stemming saw section to remove the pegs from the pods. Pods were collected in 75 liter trash cans for transportation between the field and dryers. Each container weighed about 40 kg when filled with green peanuts. Peanuts were placed in a stationary drying bin with a floor area of 100 x 120 cm to a depth of 45 cm.

The drying procedure used from 1973-1976 has been described (12). Initial moisture contents ranged from 50-65%. Ambient air was passed through the peanuts for the first 24 hr, then heated air was passed through the peanuts until dry (8% moisture). The upper temperature limit was controlled by a thermostat set at 32°C. The gas pressure was regulated to give a 6.1°C heat rise above the ambient temperature. No direct humidity control on the dryers was used during 1973-1976.

In 1977 the thermostat and gas pressure controls were set as before; however an experimental humidity control (Steele 1979, unpub.) based on wet bulb depression was also added. For the first 24 hr the control was set so that heat was added whenever the wet bulb depression in the dryer plenum was less than 1.4°C. This setting was increased each day until the fifth day when it was set at 7.5°C (Table 1). The control remained at this level unti the peanuts were dry.

Samples to be tested for germination were taken from each seed lot in 1973-1977. Market grade samples from Florigiant and VA 72R were taken in 1975-1977 and from VA 61R in 1975 and 1976. Field observations were made in the succeeding generation for stand and varietal purity.

Results and Discussion

The first objective of a new harvesting system was reduction of the labor requirement. Harvest

Table 1. Drying schedule for direct harvested breeder seed peanuts in 1977.

Time From Harvest (Hrs.)	Wet Bulb Depression + (°C)	Associated Relative Humidity (%) With Plenum Air Temperatures (°C)				
		4.4°C	10.0°C	15.5°C	21.1°C	26.6°C
0 - 24	1.4	80	80	85	85	90
24 - 48	2.8	60	70	70	80	80
48 - 72	4.7	50	50	55	60	70
72 - 96	5.8	20	35	45	55	60
96 -	7.5	10	20	30	45	50

+ Controller set point, burner with maximum heat rise of 6.1°C on if wet bulb depression in plenum air was less than set point and air temperature in plenum was less than 32°C.

Table 2. Germination of 3 peanut varieties from 1973 - 1977 harvested with a direct harvester.

Variety	% Germination +				
	1973	1974	1975	1976	1977
Florigiant	85‡	80	85‡	90	96
VA 72R	85‡	92	98	83‡‡	94
VA 61R	85‡	83‡‡	85‡	83‡‡	84

+ Germination tests conducted by Virginia Department of Agriculture and Commerce Seed Laboratory.

‡ Germination percentages equal to or greater than 85 percent.

‡‡ Peanuts subjected to temperatures 0°C or less during drying.

Table 3. Direct harvested breeder seed peanuts: market grades of 2 varieties, 1975 - 1977 and one variety, 1975 - 1976.

Grade Factor +	Florigiant 1975	Florigiant 1976	Florigiant 1977	VA 72R 1975	VA 72R 1976	VA 72R 1977	VA 61R 1975	VA 61R 1976
% ELK	41	36	42	38	30	31	25	23
% SMK	69	63	68	68	62	61	65	64
% OK	3	4	2	2	4	3	3	3
% DK	1	0	0	2	0	0	2	0
% SS	3	5	1	1	3	0	1	2
% Meat	76	72	71	73	69	64	71	69
% Frost Damage	0	0	0	0	0	0	0	0

+ Values based on a 454 gram sample from each seed lot.

% ELK = Seed that ride a 0.85 x 2.54 cm screen.

% SMK = Whole seed that ride a 0.6 x 2.54 cm screen.

% OK = Seed that pass through a 0.6 x 2.54 cm screen.

% DK = Any damaged seed due to disease, insects or weather.

% SS = Split or broken seed that are undamaged.

% Meat = All seed in the sample.

% Frost Damage = Seed that have been damaged due to frost.

time required for the direct harvest method was comparable to that of the windrow-combine method, which has been shown (1, 2, 4, 6, 7) to be faster than the stackpole method. Not only was the time/hectare less, but the number of people required to efficiently operate the equipment was less. In the direct harvest method two to four people were required, while in the stackpole method four to eight people were needed.

Time for cleaning out the direct harvester between varieties was comparable to that for cleaning out the stationary picker used in the stackpole method (5 - 15 min). This was faster than the time required for a combine (30 - 120 min). Thus, the direct harvester had the advantages of the faster picking time of the combine and the faster cleaning time of the stationary picker. The number of trips through the field was reduced from two to three for the stackpole and windrow-combine methods to one for the direct harvest method.

The second objective was to maintain a high level of germination. Table 2 shows that satisfactory germination levels were obtained with the direct harvest method. All samples germinated above 80% and ten samples germinated above 85%. Certified seed in Virginia are required to germinate above 85% to be labeled as "certified 1" seed and between 75 and 84% to be labeled "certified 2" seed. Thus, seed from the direct harvest method met certification requirements.

Three of the five samples that germinated below 85% were harvested after frost damage to the plants and were in the drying process during freezing or below freezing temperatures. This could explain the lower germination values for these samples since peanuts harvested before (Florigiant - 1976) or after (VA 72R - 1974) these lower temperatures had higher germination percentages (Table 2). Similar effects of freezing temperatures on peanuts in the dryer have been reported previously (12).

Peanuts grown in the same field but harvested by the windrow-combine method during these cold temperature periods had germinations of 40 - 75%. Thus, had our seed been harvested by the windrow-combine method they would not have met certification standards. In addition, no frost damage was detected in any of the grade samples (Table 3), even though some of the peanuts were direct harvested after severe frosts. Therefore, not only were acceptable levels of germination maintained, but the fourth objective - to reduce the risk of frost damage - was satisfied.

The third objective was to maintain varietal purity at 100%. The design of the direct harvester permitted easy and rapid cleanout between plots. This feature essentially eliminated machine carryover or mixing between varieties. Field observations in the succeeding generation confirmed that no mixing had occurred between varieties the previous year. In comparison carryover values of 1% have been reported for the windrow-combine method (8).

Another indication of seed quality is the market grade. Grade samples from each of the seed lots gave acceptable levels of damaged kernels, sound splits and meat content (Table 3). The high percentage of splits for Florigiant in 1976 was due to storage and shelling conditions after harvesting and curing, not to the harvesting and curing methods used. The market grades in this study (Table 3) were comparable with grades of peanuts harvested by the windrow-combine method and those from other direct harvesting studies (1, 12).

The direct harvesting method has four other advantages for seed production. First, peanuts are not exposed to adverse weather conditions (rain, frost, etc.) after digging. Second, the risk of pod losses or degradation as the result of adverse (too slow, rapid, etc.) windrow drying conditions is eliminated. Third, the potential for contamination by fungi and insects during artificial drying and storage is reduced as a result of less mechanical damage during harvest. Fourth, the direct harvester can be used under wetter field conditions than a conventional combine. Thus, seed quality and yield of peanuts can be improved with direct harvesting and curing.

Disadvantages for the direct harvesting method are the length of the curing time, energy costs, and availability of drying facilities with adequate temperature and humidity controls. Total drying time used for direct harvested peanuts is 5 - 7 days. This is less than that used in the stackpole method (30 - 60 days) and about the same as that used in the windrow-combine method (4 - 6 days in the windrow plus 3 - 4 days on the dryer). Artificial drying time for direct harvested peanuts is about twice that for windrow - combined peanuts. Since peanuts have a higher initial moisture content and are in the dryer longer, the cost of drying direct harvested peanuts is greater than the cost with other methods (12). While dryers used for the windrow-combine method can be used for the direct harvest method, better controls and closer management are needed when drying direct harvested peanuts for seed. Thus, more drying facilities may be required or existing facilities may need modifications. However, the advantages of the direct harvest method - more control of the entire curing process, less risk of damage in the windrow due to frost and/or rain, and less labor - override these disadvantages.

The results showed that the direct harvesting method satisfied the four objectives required for a new harvesting method of breeder's seed. Compared to the stackpole method, labor was reduced, satisfactory levels of germination and varietal purity were obtained, and the risk of frost damage was minimized. Thus, the direct harvest method gives a better chance for production of high quality seed than either the stackpole or windrow-combine methods under Virginia conditions.

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