Effect of Plowing Date and Certain Crop Rotations on Peanut Productivity[1]

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ABSTRACT

The relationship of certain land management systems to productivity and pod breakdown disease incidence in peanuts (**Arachis hypogaea**) was studied in Virginia during 1971-74. Main treatments were three dates of moldboard plowing prior to planting peanuts in the rotations. Splitplot treatments were 2-year rotations: (I) peanuts followed by rye (**Secale cereale**) winter cover crop then corn (**Zea mays**) followed by rye winter cover crop; (II) peanuts followed by rye winter cover crop then soybeans (**Glycine max**) followed by no winter cover crop (except weeds); (III) peanuts followed by rye winter cover crop then no summer crop (residue of unharvested rye) nor cover crop planted; (IV) peanuts followed by rye winter cover crop then corn followed by fallow in winter, weeds prevented.

Dates of plowing treatments affected peanut productivity most. Gross crop values and yields in plots plowed in December were 7%, and 18-to-20%, respectively, higher than when plots were plowed in March or May. Sound mature kernel contents also were lower for the later plowing dates.

Differences among rotation treatment means occurred only when plots were plowed in May. Gross crop values were higher for rotation I than for rotation III and IV. In 1974, gross crop values obtained from plots plowed in March in rotation IV were equivalent to those from plots plowed in December.

None of the treatments differentially affected pod breakdown disease significantly. However, the percentage of rotted pods averaged somewhat lower in plots plowed in December.

Additional index words: Pod breakdown, corn, rye, soybeans, cover crops.

A very common crop rotation utilized in the peanut (*Arachis hypogaea* L.) producing area of Virginia is corn *Zea mays* L.) one or more years followed by peanuts. Such rotations were altered to include periods of layout or non-cropping (soil bank) except for rye (*Secale cereale* L.) cover crop during imposition of the Federal program subsidizing acreage restriction of corn and other crops. Growers reported increased incidence of several diseases in peanuts following periods of crop layout.

Losses from certain soil-borne fungi in peanuts showing no apparent foliar disease symptoms were reported by Garren (1). Garren (2,3) later demonstrated that *Pythium myriotylum* Drechs. and *Rhizoctonia solani* Kuehn were the principal pod rotting organisms in a disease called pod breakdown to distinguish it from other in-soil rots of peanut pods which have associated foliar symptoms. Garren and Porter (4) studied the role of cellulose from cow manure, peanut hay, and rye straw and reported that pod breakdown disease may be increased by high levels of N with or without cellulosic components of organic matter.

The research reviewed above dealt insufficiently with the relationship of peanut productivity and pod breakdown disease to crop rotations and ground cover preceding peanuts. Results of studies conducted from 1971 to 1974 to investigate these factors further are reported in this paper.

Materials and Methods

This experiment was conducted at the Tidewater Research and Continuing Education Center, Holland Station, Suffolk, Va. during 1971-74. An area in which considerable pod breakdown had occurred previously was selected. The soil type was a moderately well-drained Woodstown loamy fine sand, classified as Aquic Hapludult (fine, loamy, siliceous, mesic). Soil tests (5) of the plow layer indicated available nutrient levels during the experiment were approximately 70, 100, 900, and 100 kg/ha of P, K, Ca and Mg, respectively. Soil pH was 6.2. Approximately 20 kg/ha of P and 80 kg/ha of K were applied to the summer crops preceding peanuts in the rotations each year.

Corn or soybeans were planted in late April in rye winter cover crop, which followed each crop of peanuts, by the no-tillage procedure (seeds dropped in a slit made by fluted rolling coulters followed by a packing wheel). Prior to planting corn or soybeans in the spring, the rye was killed with paraquot. Populations of corn and soybeans were approximately 50,000 and 300,000 plants per hectare, respectively. Yields of corn, or rye foliage were not obtained. The winter rye cover crop was planted after corn or peanuts by broadcasting 55 kg/ha of seed and disking moderately. Preemergence applications of atrazine and alachlor were made on corn, and alanap or dinitro on soybeans. Preparation of land for peanuts included moldboard plowing (45.7 cm plows) to a depth of 25 cm which provided complete trash burial followed by several diskings for seedbed preparation and pesticide incorporation. Peanuts were planted the same day over all plowing dates each year.

Thiram — treated NC 17 peanut seeds were mechanically planted to approximate 75,000 plants per hectare during mid-May each year in rows 91 cm apart. Virginia recommendations were followed for use of vernolate, benefin, alachlor, alanap, dinitro, diazinon, fonofos, carbaryl, and benomyl. Supplemental weed control in peanuts was provided by cultivation and hoeing. Landplaster at a rate of 675 kg/ha was applied on peanuts in the early bloom stage each year.

Treatments were arranged in a randomized split-plot complete block design with four replications. Subplots were four 91.4-cm rows 15.2 m long. Two areas were utilized in this experiment so that peanuts, corn or soybeans were grown each year. The main plot treatments were dates of plowing and the split-plot treatments were four 2-year rotations. All treatments are given in table 1.

Pod breakdown observations were made 1- to 2-weeks prior to normal digging time of peanuts. Four normal appearing plants randomly selected from each subplot were carefully dug, washed, and the fruits removed by hand. The percentage of affected fruit per plant was determined.

The central two rows of each subplot of peanuts were dug mechanically, allowed to dry partially in the windrow, then combined and dried with heated air. Fruit yields were calculated on a 9% moisture basis. Peanut seed grades were determined using a 454 g unshelled fruit sample obtained after drying. Extra large (ELK) or sound mature (SMK) kernels were undamaged seeds retained by a sieve with slots approximately 8.5 by 25.4

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mm or 5.9 by 25.4 mm, respectively. The gross crop values of peanuts produced per hectare in the various treatments were estimated by use of the USDA peanut price-support loan schedules in effect the particular year. The data were subjected to an analysis of variance and significant differences were determined by Duncan's Multiple Range Test.

Results and Discussion

Data obtained concerning the effect of plowing date and 2-year rotations on several peanut crop factors are given in Table 1. Only data for 1974 and means for the last 3 years of the 4-year study are presented since they indicate all pertinent results obtained.

Gross crop values were affected most by the date of plowing. The values obtained from plots plowed in December were significantly higher than when plots were plowed in March which, in turn, were significantly higher than when plots were plowed in May. These effects were apparent each year of the experiment but differences were significant only in 1973 and 1974. Differences in gross crop values were less marked and more inconsistent among the rotations or cropping systems than dates of plowing. However, the interaction between dates of plowing and rotations was significant in 1974, and for similar data combined over years. The gross crop values for plots plowed in March were equivalent to those for December when a fallow soil condition was maintained after corn and prior to peanuts. Also in 1974, gross crop values for the May plowing date were higher in the peanuts-corn (with cover crop) rotation than in the rotations including the soil bank or fallow treatments.

Treatment effects on crop yields were similar, generally, to those mentioned concerning gross crop values. Yield normally is the principal factor in the calculation of crop value. In 1974, the yields for the December plowing treatment were higher than for March which, in turn, were higher than for the May plowing treatment. However, average yields over years for the December and March plowing dates were not significantly different.

Seed size factors (Table 1) were not influenced marked by treatments. In 1972 and 1973, but not in 1974, contents of both SMK and ELK were slightly higher in the plots plowed earlier. Differences over years in contents of SMK among plowing dates were significant, although small. The rotations did not affect these factors appreciably.

None of the treatments in this experiment affected pod breakdown incidence significantly. However, trends indicated December plowing may reduce damage from this disease. The incidence of pod breakdown disease during the experiment was less than observed in the site prior to initiation of this study.

The favorable effect of December plowing prior to peanuts in the rotation seems worthy of special emphasis. Specific causes for these results were not elucidated. However, a possible factor is indicated since equivalent yields and gross crop values were obtained for the December and March plow-

Table 1. Effect of plowing dates and certain 2-year rotations on several peanut crop factors, Holland Station, Suffolk, Va., 1972-74.

Dates of Plowing	Gross Crop Value 1974	Gross Crop Value 1972-74	Crop Yields 1974	Crop Yields 1972-74	Sound Mature Kernels 1974	Sound Mature Kernels 1972-74	Extra Large Kernels 1974	Extra Large Kernels 1972-74	Pod Breakdown 1974	Pod Breakdown 1972-74
	- $/ha -		- kg/ha -		- % -		- % -		- % -	
Corn followed by Rye Cover Crop / Peanuts followed by Rye Cover Crop										
December	1,740	1,445	3,855	3,695	74	71	30	34	3	4
March	1,530	1,310	3,355	3,340	75	69	33	34	11	11
May	1,640A	1,320A	3,625A	3,425A	73	68	34	33	5	6
Soybeans followed by no Cover Crop (Weeds Present) / Peanuts followed by Rye Cover Crop										
December	1,805	1,460	3,875	3,710	74	69	34	34	4	6
March	1,545	1,380	3,440	3,550	74	70	32	34	12	10
May	1,585AB	1,195AB	3,535AB	3,085AB	74	68	32	32	8	9
No Crop (Soil Bank) but Residue of Rye not Harvested / Peanuts followed by Rye Cover Crop										
December	1,710	1,510	3,825	3,860	72	70	34	35	4	3
March	1,650	1,325	3,595	3,460	74	70	34	33	20	9
May	1,200B	1,025B	2,845B	2,790B	71	67	32	31	13	9
Corn followed by Fallow (No Plant Growth in Fall or Winter) / Peanuts followed by Rye Cover Crop										
December	1,780	1,450	3,910	3,645	74	70	34	36	3	4
March	1,800	1,435	3,920	3,680	75	69	34	33	7	7
May	1,270B	1,120B	2,845B	2,985B	73	68	32	31	4	6
Means for Plowing Dates										
December	1,760a	1,465a	3,865a	3,725a	73	70a	33	35	3	4
March	1,630b	1,360b	3,575b	3,510a	74	69b	33	34	12	9
May	1,425c	1,165c	3,210c	3,070b	73	68c	33	32	8	8

Comparable means in the same column followed by unlike letters of similar size are significantly different at the 5% level.

ing dates in 1974 when a fallow soil condition was maintained following a corn crop. December plowing reduces the occurrence of apprecable quantities of fresh plant material in the fruiting zone near peanut planting time. The fallow treatment prevented the growth and incorporation of fresh plant material before planting peanuts. Yet, the fallow treatment resulted in decreased peanut yields and crop values for plots plowed in May. In fact, these variables were highest for the May plowing date in the rotation where a rye cover crop was grown and turned under prior to peanuts.

Implementation of early winter plowing before peanuts prevents use of the land in a winter forage program and may increase soil erodability. Certainly additional research on this practice appears warranted before recommendation.

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