

DOUBLE-CROPPING PEANUTS AND WHEAT  
UTILIZING CONVENTIONAL AND  
NO-TILL PEANUT PLANTING  
TECHNIQUES

By

GREGORY ALAN TURPIN

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Bachelor of Science in Agriculture

Oklahoma State University

Stillwater, Oklahoma

1983

Submitted to the Faculty of the Graduate College  
of the Oklahoma State University  
in partial fulfillment of the requirements  
for the Degree of  
MASTER OF SCIENCE  
December, 1986

Thesis  
1986  
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Thesis Approved:

*James S. Kirby*  
-----  
Thesis Adviser  
*James R. Sholar*  
-----  
*Eugene S. Kuyper Jr.*  
-----  
*W. M. M. M. M.*  
-----  
*Norman N. Dusham*  
-----  
Dean of the Graduate College

## ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to Dr. James S. Kirby for his time, constructive criticism, direction, and friendship throughout the course of this study.

Grateful acknowledgments are extended to Dr. Eugene G. Krenzer, Dr. Hassan A. Melouk, Dr. James R. Sholar, and Dr. James S. Stiegler for serving on the advisory committee and for their valuable assistance and constructive criticism during the preparation of this thesis.

Special thanks are expressed to Dr. Ronald W. McNew for his assistance in the statistical analysis of this study, to Dr. Helen Fagbenle for determining the nematode numbers in 1985, and to Mr. Tom Stevens for his assistance throughout the study. Recognition is due Mr. Willie Stokes and personnel at the Caddo Research Station. Special thanks are also expressed to Mr. Grover Skaggs for providing the area where the 1984 experiment was conducted. Appreciation is given to Dr. Raleigh Jobes for his assistance with the economic analysis needed for the study.

Special appreciation is given to the author's parents, Ralph and Jimmie Nell Turpin, for their encouragement, financial support, and interest during the course of his studies.

The author expresses his greatest appreciation and love to his wife, Ines, and his daughter, Nicole, for their love, support, encouragement, and patience throughout his educational program and thesis preparation.

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## Chapter I

### INTRODUCTION

Many agricultural producers concerned with the current farm economy in the United States are interested in utilization of their land to its fullest potential while trying to reduce expenses at the same time. Double-cropping using no-till planting techniques is one possible solution to the problem. No-till double-cropping offers the potential for increasing yields per unit land area while reducing trips over the field (Phillips and Phillips, 1984), reducing wind and water erosion (Fenster et al., 1977.; Chepill and Woodruff, 1963.; Vaughan, 1985), reducing soil compaction (Phillips and Phillips, 1984), utilizing available soil moisture more efficiently (Blevins et al., 1971), and increasing the utilization of solar energy and other natural resources (Sanford et al., 1973).

New herbicides and planting equipment, increased equipment efficiency, and improved crop varieties that are high yielding when grown in a shorter season have made no-till double-cropping feasible and profitable throughout the United States particularly in the Southern portion of the country. As a result, producers in the Southern U. S. have shown an interest in double-cropping peanuts (*Arachis*

hypogaea L.) and small grains, particularly wheat (*Triticum aestivum* L. em Thell).

Traditionally peanuts have been grown on sandier soils as a full season summer annual crop using conventional plow and disk tillage methods prior to planting. These methods leave the soil surface very susceptible to wind and water erosion which results in the loss of valuable topsoil (Fenster et al., 1977). Planting peanuts into the stubble of a preceding wheat crop could substantially reduce such losses.

Although there may be many advantages to a no-till double-cropping system, there are inherent problems. No-till double-cropping requires a high level of management because of the shorter growing season for the summer crop to mature (Phillips and Phillips, 1984). A no-till double-cropping system requires more of a producers time and available labor than a single crop per year. It also creates a greater demand upon the soil's inherent fertility. Producers planning to grow peanuts in a no-till double-cropping system in Oklahoma should be extremely cautious because after removing the winter annual grain crop they may have as little as 90 days to mature the peanut crop before frost. Low temperatures encountered in the fall may slow or stop peanut maturation altogether thereby limiting yields and market grades. Therefore research was needed to determine if it is agronomically and economically feasible to grow no-till double-cropped peanuts after wheat in Oklahoma.

The objectives of this study were to compare the agronomic and economic potential of six different cropping systems involving peanuts and/or wheat and to analyze the growth and development of the peanuts in the various cropping systems.

Due to unforeseen problems associated with the location selected in 1984, the study was moved to a different location in 1985. Therefore results for each year are reported independently.

## CHAPTER II

### REVIEW OF LITERATURE

#### Double-Cropping and Tillage Effects

Two important benefits that are commonly associated with reduced or no-tillage planting systems is their proven reduction of wind and water erosion. Chepill and Woodruff (1963) found that surface residues of 1882 kg/ha reduced wind erosion by as much as seven fold on a bare fallow fine sandy loam soil in Kansas. Generally, wind erosion is most severe on sandy soils and since peanuts are grown on sandier soils, young seedlings can be severely damaged by blowing sand particles. Leaving some or all of the residue from a previous crop on the soil surface could greatly reduce this risk. Water runoff and associated soil loss was dramatically reduced by conservation tillage practices as reported by Fenster et al. (1977). The authors found that a stubble mulch fallow system reduced runoff on a very fine sandy loam soil by 60%, and also reduced associated soil loss by 86% when compared to a bare fallow system. Although wind and water erosion parameters were not studied in this experiment, they are important benefits of reduced or no-tillage systems.

Mixon and Dowler (1984) studied the potential of Pronto, Comet, and Florunner in a double-cropping system in

Georgia and found that all cultivars had higher pod yields, higher TSMK, and lower OK when grown for 114 days versus 99 days when planted in early April or May. They also found that Pronto and Comet had a yield and value advantage over Florunner for the 99 day growth period. In a summer test planted July 27 and grown for 112 days, Mixon and Dowler (1984) reported lower pod yields than those in the spring test. They found greater yields, higher TSMK, lower OK, and a higher dollar value per acre for Pronto and Comet compared with Florunner. These results demonstrate the need for early maturing peanut cultivars in a double-cropping system.

Various peanut planting techniques in double-cropping systems have been studied (Bhatnagar et al., 1983; Cheshire et al., 1985; Minton et al., 1985; and Mixon and Dowler, 1984). Mixon and Dowler (1984) and Minton et al. (1985) found that rip-planting, a form of minimum tillage, reduced peanut yields when compared with conventionally planted double-cropped peanuts in Georgia, while Cheshire et al. (1985) on the contrary reported rip-planted double-cropped peanuts in Georgia yielded significantly more than double-cropped peanuts planted using conventional methods. Cheshire et al. (1985) also reported that no-till monocropped peanuts planted into a cover crop yielded significantly more than no-till double-cropped peanuts. The authors did not mention the total value per acre for the two systems. In India, Bhatnagar et al. (1983) reported no significant yield differences between no-till and conventionally planted

double-cropped peanuts after wheat on a sandy soil which contained 94.2% sand, 1.8% silt, and 3.7% clay when all previous wheat residues were removed. However the authors found conventionally planted double-cropped peanuts yielded significantly more (19%) than no-till double-cropped peanuts when planted on a sandy loam soil containing 74.1% sand, 12.3% silt, and 13.6% clay. The authors concluded that the sandy loam soil was restrictive to root growth due to the rootbed structural condition. Loosening of the sandy loam soil by tillage produced a favorable effect on root growth and yield.

Weed control has always been a major concern when planting peanuts in a reduced or no-tillage situation. Today, however, selective herbicides can under certain circumstances replace the need for plowing and disking prior to planting. In a study conducted from 1980-1982 in Florida, Brecke and Teem (1983) found that the best control of both annual grasses and broadleaf weeds in no-till planted peanuts was obtained by using either alachlor, metolochlor, pendimethalin, or ethalfluralin applied pre-emerge followed by a ground-cracking application of alachlor, metolochlor, or ethalfluralin plus a tank mix of dinoseb and naphthalan followed by another post-emergence application of dinoseb. The authors found yields of no-till peanuts compared favorably with conventionally planted peanuts when similar herbicide programs were used. Colvin et al. (1985) in Alabama found that weed control from their five best minimum-

till treatments was equal to or better than the conventional treatment which included benefin pre-plant incorporated, alachlor and naphthalan plus dinoseb at ground-cracking, plus two cultivations. The authors reported that peanut grade was unaffected by treatment. They found that, although peanut yields were similar in 1983, the five best minimum-till treatments netted more profit than the conventionally planted treatment. In 1984 the authors found all five selected minimum-till treatments outyielded the conventional treatment with two of the five being significantly better. The best minimum-till treatment for both years was benefin and metolochlor pre-plant incorporated, dinoseb and ethalfluralin at ground-cracking, and paraquat as an early post directed spray. This system netted \$77/ha more in 1983 and \$251/ha more in 1984 than the conventional treatment. In a recent study in Alabama, Hartzog (personal communication, 1986) found that weed numbers tended to be higher in rip-planted plots when compared with conventionally planted plots, but these were readily controlled with herbicides in all cases. He concluded that weed control in the reduced tillage system was not a problem, and he also found no yield reductions due to weed pressures in the reduced tillage system.

Peanuts have traditionally been planted using conventional plow and disk tillage methods which have been shown to reduce the incidence of various disease and insect pests associated with previous crop residues (Campbell et al., 1985; Reed et al., 1958; and Wright and Porter, 1985).

Researchers have also reported reduced numbers of various peanut pests associated with minimum or no-till systems when compared with conventional systems (Campbell et al., 1985; Cheshire et al., 1985; Minton et al., 1985; and Wright and Porter, 1985). Cheshire et al. (1985) and Hartzog (personal communication, 1986) reported no significant differences in the severity of Southern blight caused by *Sclerotium rolfsii* Sacc. in rip-planted plots versus conventional plots. In one instance the severity of Southern blight was lower in rip-planted double-cropped peanuts behind wheat (Minton et al., 1985). In the same study average yields were greater for plowed treatments (5298 kg/ha) versus rip-planted treatments (4908 kg/ha). Pod rot severity (causal organism not given) was generally higher and yields reduced in no-till plots in a study conducted by Wright and Porter (1985) in Virginia, while Campbell et al. (1985) found pod rot severity (causal organism not given) was lower in no-till plots planted with the cultivars NC6 and Florigiant. Wright and Porter (1985) also found that percent defoliation, number of lesions per leaflet, and number of lesions per plant due to early leafspot (*Cercospora arachidicola* Hori) and late leafspot (*Cercosporidium personatum* Deighton) were reduced in no-till plots. Hartzog (personal communication, 1986) reported no visual suggestion of tillage treatment differences in early or late leafspot control. He also found no significant differences in root-knot nematode (*Meloidogyne arenaria* Neal Chitwood) numbers among tillage treatments. Damage due to

other pests such as lesser cornstalk borer (*Elasmopalpus lignosella* Zeller) and potato leafhopper (*Empoasca fabae* Harris) has been reported to be lower in reduced tillage peanuts (Campbell et al., 1985; Cheshire et al., 1985). In at least one case, the incidence of thrips (*Frankliniella fusca* Hinds) was also less in no-till peanuts versus conventionally planted peanuts (Campbell et al., 1985).

### Growth Analysis

Studies of crop growth and development are beneficial in understanding factors which may increase or limit potential yields. Peanut plants usually flower profusely but a relatively small proportion of the ovaries become mature fruits. Many pegs fail to reach the soil and pod enlargement fails to occur. Smith (1954), while working with the Virginia variety, Whites Jumbo Runner, found that only 63.5% of the fertilized flowers elongated as pegs. Of the pegs which did elongate, one-third, which was about 21.4% of the original flowers, actually reached pod enlargement. Although a fifth of the flowers produced pegs which began to develop pods, the author found that one-third of these pods failed to reach maturity. He also reported that the mature fruits harvested in his study represented only 13.5% of the original flower production. McCloud (1974), while studying Florunner in Florida, found that after fruiting had been underway for three weeks, approximately 50% of the pegs had produced pods. He suggested that a yield of 346 kg/ha dry matter had been

obtained at that time. At another location, the author found that 30 of the 45 pegs per plant had pods which produced a dry yield of 4680 kg/ha. The author stated that a potential yield of 6940 kg/ha could have been attained if the 15 unfilled pegs had developed into pods. Senthong (1979) found similar pod numbers in a separate Florida study. He reported the maximum pod number for Florunner to be 34 at 120 days, whereas Apollo, a late maturing bunch type cultivar from Rhodesia, produced a maximum of 30 pods at 113 days. Hand harvested pod yield was 4258 kg/ha for Florunner and 3087 kg/ha for Apollo at 134 days. The author stated that the difference in the two cultivars was due to the fact that Florunner partitioned more of its assimilate to reproductive parts than Apollo. Duncan et al. (1978) also found partitioning of assimilate had the greatest effect on peanut yield. They found the partitioning factors near harvest (the division of daily assimilate between reproductive and vegetative plant parts) for Dixie Runner, Early Runner, Florunner, and Early Bunch to be 40.5, 75.7, 84.7, and 97.8%, respectively. It has generally been shown that pod growth rates of peanuts are linear up until maturation when growth ceases (Schenk, 1961.; Senthong, 1979.; Boote, 1976). Schenk (1961) performed a growth analysis study on Virginia Bunch 67 and Dixie Spanish in 1958. He found the pod growth rate to be greater for the Dixie Spanish variety when compared with the Virginia Bunch 67 cultivar. Although the author did not present the actual rates per day, extrapolation from graphs

given show rates to be approximately 20.8 mg/pod/day for Dixie Spanish and 19.7 mg/pod/day for Virginia Bunch 67. Boote (1976) studied the pod growth rate of Florunner and found fruit set during the first four weeks of pegging had a similar linear growth rate of 33.5 mg/pod/day and accounted for 78% of the yield at 133 days. Fruit set between 5 and 7 weeks had a slower growth rate. The author suggested that progressively smaller pods may occur for later set fruit. This may be caused by older fruits using photosynthate while younger fruits are in the pod expansion phase. Senthong (1979) found pod growth rates of 6.0 and 4.3 g/m<sup>2</sup>/day for Florunner and Apollo, respectively. The partitioning coefficient for Florunner was 79.7% compared with 56% for Apollo. When studying 22 different genotypes, Senthong (1979) found that UF77117 produced the largest pod growth rate of 9.3 g/m<sup>2</sup>/day compared with Dixie Runner which produced a pod growth rate of 3.2 g/m<sup>2</sup>/day.

## Chapter III

### MATERIALS AND METHODS

#### 1984 Experiment

The study was conducted on a peanut producers field near Ft. Cobb, Oklahoma, during the summer of 1984. The soil of the experimental area was a Pond Creek fine sandy loam, a member of the fine-silty, mixed, Thermic Pachic Argiustolls. Particle size analysis showed the soil to contain 71% sand, 6% silt, and 23% clay and belong to the sandy clay loam textural class. The upper six inches of the soil profile contained 0.7% organic matter.

Peanuts and wheat had been double-cropped on the field for two years prior to the initiation of the study. Vona wheat was planted on the entire experimental site at the rate of 100 kg/ha during the fall of 1983.

The experimental design was a randomized complete block with the following six cropping systems (treatments) replicated four times.

DCNT+S. Double-cropped spanish peanuts and wheat, peanuts planted no-till, straw remaining on plots.

DCNT-S. Double-cropped spanish peanuts and wheat, peanuts planted no-till, straw removed from plots.

DCCT. Double-cropped spanish peanuts and wheat, peanuts planted after moldboard plowing and disking, straw turned under.

MCS. Monocropped full season spanish peanuts planted after moldboard plowing and disking of wheat cover crop.

MCR. Monocropped full season runner peanuts planted after moldboard plowing and disking of wheat cover crop.

MCW. Monocropped wheat, summer fallow.

The overall plot size was 11.0 X 18.3 m with 15.2 m alleys between replications. Soil tests were taken in May 1984 and all nutrients were at adequate levels for maximum peanut yields.

On May 24, 1984 the wheat forage on all plots designated to be planted to the monocropped peanut systems was turned under with a moldboard plow and disked four times to break up the large clods present. Benefin was then applied pre-plant incorporated to the two systems at the rate of 1.7 kg ai/ha and disked twice to incorporate. The spanish cultivar Spanco was planted on the MCS system at the rate of 110 kg/ha and the runner variety Florunner was planted on the MCR system at the rate of 115 kg/ha. Both varieties were planted 5 cm deep in rows 0.92 m apart using an International model 185 four-row planter. All seed were treated with a recommended fungicide. Stand counts were taken three weeks after planting.

The wheat on the remaining treatments was allowed to mature and was harvested for grain on June 28, 1984 with a Massey Ferguson model 500 combine equipped with a straw spreader. The plots designated to be planted to the DCCT system were plowed and disked like the MCS system with the exception that DCCT was disked only twice before the

application of benefin and two times thereafter. The loose straw remaining on DCNT-S was removed to simulate baling the straw. The double-cropped treatments were planted 5 cm deep in rows 0.92m apart using a John Deere model 7000 Max-Emerge four-row planter set to plant 75 kg/ha of Spanco seed. A tank mix of metolochlor at 2.2 kg ai/ha and glyphosate at 2.2 kg ai/ha was applied pre-emergence to the peanuts on the no-till planted systems. The MCW system received a single application of glyphosate at 2.2 kg ai/ha for weed control. Visual estimations of weed control were taken on August 9, 1984. Stand counts for the double-cropped treatments were taken three weeks after planting. Sethoxydim at 0.45 kg ai/ha was applied on August 10, 1984 to DCNT+S, DCNT-S, and MCW for the control of volunteer wheat.

Peg and pod samples were taken August 29, 1984 and every week to two weeks thereafter until harvest. The peg/pod sampling involved digging five plants per plot from rows three, four, nine, or ten of the 12 row plots. All pegs and those pods greater than 0.6 cm in diameter were removed from the plants, placed in sealed plastic bags, put on ice, and transported to the laboratory for analysis. Pegs and pods per plant were then separated, counted, and fresh pod weights per plant were taken. Dry pod weights per plant were recorded after placing the samples in a 55 C forced-air oven for 72 hours. Only replications one and two were sampled for the growth analysis part of the study. A

potential yield per hectare for each observation was calculated using the formula:

$$\frac{\text{PLANTS}}{\text{-----}} \times \frac{\text{PODS}}{\text{-----}} \times \frac{\text{WEIGHT}}{\text{-----}} = \frac{\text{WEIGHT}}{\text{-----}}$$

$$\text{AREA} \quad \text{PLANT} \quad \text{POD} \quad \text{AREA}$$

Rainfall received during the growing season totalled 18.7 cm. Supplemental sprinkler irrigation was used to apply an additional 35.6 cm of water to the experimental area. Due to unforeseen problems with the irrigation system, the peanuts went through several short periods of drought stress between irrigation applications.

All plots were dug with a Paulk model 2200 two-row digger-shaker-inverter. MCS was dug 132 days after planting (dap). All double-cropped treatments were dug 110 dap and the MCR system was dug 153 dap. All peanut treatments were threshed with a Lilliston model 1500 peanut combine with a sacker attachment. MCS was threshed seven days after digging. The other four treatments were not threshed until three weeks after digging due to inclement weather. Due to an oversight, the green weights of samples taken to determine moisture content were not recorded, therefore yields and gross returns for 1984 are reported based on green weights. The center four rows of the 12-row plots were used for yield and grade information. After threshing, a 200 g sample of pods was taken from each plot for quality grade determination based upon the Federal-State Inspection Service Peanut Grading Standards and included percentages of:

Sound mature kernels (SMK) - spanish type kernels which ride a 0.60 X 1.91 cm screen and runner type kernels which ride a 0.64 X 1.91 cm screen.

Sound splits (SS) - kernels that are split and show no signs of damage.

Total sound mature kernels (TSMK) - the sum of SMK and SS.

Other kernels (OK) - kernels which fall through their respective screens and are not damaged.

Damaged kernels (DK) - kernels which show signs of damage.

Total kernels (TK) - the sum of SMK, SS, TSMK, OK, and DK.

Soil tests were taken October 10, 1984 from each plot to determine if soil fertility status was affected by the various cropping systems.

#### 1985 Experiment

The study was conducted at the Caddo Research Station near Ft. Cobb, Oklahoma, starting in the fall of 1984. The soil of the experimental area was a Cobb fine sandy loam, a member of the fine-loamy, mixed, Thermic Udic Haplustalfs. Particle size analysis showed the soil contained 77% sand, 10% silt, and 13% clay and belonged to the sandy loam textural class. The upper six inches of the soil profile contained 0.6% organic matter.

Peanuts and sorghum [*Sorghum bicolor* (L.), Moench] had been grown on the area in 1983 and 1984, respectively. Vona wheat was planted on the experimental site on November 5, 1984 at the rate of 100 kg/ha. Prior to planting, soil tests were taken and 112 kg/ha of 46-0-0 was applied to the area and disked twice for incorporation.

The experimental design, plot size, and treatments were exactly as in the 1984 experiment. Soil tests taken in April 1985 indicated all nutrients were at levels adequate for maximum peanut yields.

Parathion at 0.56 kg ai/ha was applied to the test area for greenbug (*Schizaphis graminum* Rondani) control in early April. On April 12, 1985 the wheat forage on the MCS and MCR plots was plowed under and disked twice. Benefin at 1.7 kg ai/ha and vernolate at 3.4 kg ai/ha were applied before planting MCS and MCR on May 24, 1985. A pre-emergence application of metolochlor at 2.2 kg ai/ha was then applied to the MCS and MCR systems after planting. MCS was planted with Spanco at 100 kg/ha and MCR was planted with Florunner at the rate of 96 kg/ha. The varieties were planted with the same equipment as in the 1984 experiment. Stand counts were taken three weeks after planting.

The wheat on the remaining treatments was allowed to mature and was harvested for grain on June 20, 1985 with an Allis-Chalmers Gleaner model A combine equipped with a straw chopper. The double-cropped peanut treatments were planted exactly as in 1984 with the exception that benefin at 1.7 kg ai/ha and vernolate at 3.4 kg ai/ha were tank mixed and applied pre-plant incorporated on DCCT. A pre-emergence application of metolochlor at 2.2 kg ai/ha was applied immediately after planting to the DCCT treatment. MCW received a single application of glyphosate at 2.2 kg ai/ha. Stand counts for the double-cropped treatments were taken

three weeks after planting. Visual estimations of weed control were taken on September 10, 1985.

Peg and pod samples were taken beginning on September 3, 1985 and every week to two weeks thereafter until harvest. The sampling technique was exactly the same as in the 1984 experiment.

Rainfall received during the growing season totalled 45.2 cm. A sideroll sprinkler irrigation system was used to apply an additional 61.0 cm of water to the experimental area.

The MCS treatment was dug 138 dap. All double-cropped treatments were dug 123 dap and the MCR treatment was dug 152 dap. The number of dead or infected plants due to Southern blight were counted immediately after digging and reported as percent diseased plants for each treatment. Soil samples for Northern root-knot nematodes were taken after digging the treatments. Larvae were found by using the rapid centrifugal-flotation technique described by Jenkins (1964). Results were reported as the number of larvae per 100 cc of soil. Plots were then threshed after approximately seven days of field curing. A sample of pods was taken for moisture determination and all yields were corrected to approximately 10% moisture content. All peanut samples were graded as in the 1984 study.

Soil tests were taken two weeks prior to peanut harvest to determine if soil fertility status was affected by the various cropping systems. Since no differences were found

among treatments, 112 kg/ha of 18-46-0 was applied as recommended before planting Vona wheat. The wheat was planted on the MCS and MCW treatments on October 10, 1985 at the rate of 67.2 kg/ha. The double-cropped treatments and the MCR treatment were planted to Vona wheat on October 31, 1985 at the rate of 100 kg/ha.

All analyses for the characters studied were made at the Oklahoma State University Computer Center using the statistical analysis system SAS (1982). Data were analyzed by analysis of variance, Duncan's Multiple Range test, and linear and multiple regression techniques.

## CHAPTER IV

### RESULTS AND DISCUSSION

Precipitation during 1984, particularly during the peanut growing season, was considerably below the long term average (Table 1). Only 2.31 cm of rainfall was recorded during July, August, and September of 1984 and all cropping systems showed signs of moisture stress periodically throughout the summer months due to problems encountered with the irrigation system. Total precipitation during 1985 was above normal; however, May, July, and August were below normal.

TABLE I

DISTRIBUTION AND TOTAL RAINFALL FOR 1984, 1985,  
AND THE LONG TERM AVERAGE (LTA) AT THE CADDO  
RESEARCH STATION NEAR FORT COBB, OKLAHOMA

Month	1984	1985	LTA
-----	cm	cm	cm
January	0.00	3.66	1.83
February	3.18	6.07	3.05
March	7.52	15.62	4.42
April	7.21	9.40	6.07
May	1.50	2.46	10.95
June	12.12	16.89	8.00
July	1.02	1.50	7.95
August	0.53	4.19	6.38
September	0.76	10.67	6.88
October	5.33	11.81	5.97
November	4.70	3.00	3.91
December	12.55	0.51	3.33
-----	-----	-----	-----
Totals	56.41	85.78	68.74
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## Pod Yield

Due to an oversight in the handling of samples for moisture determination, dry weights were not determined in 1984; therefore, green weights only are reported. Assuming all systems contained the same percentage of moisture when green weights were taken, the monocropped conventionally planted runner and spanish systems significantly outyielded all double-cropped systems but were not significantly different from each other (Table II). The yield advantage of the monocropped systems is attributed primarily to their longer growing season. There were no significant differences among the double-cropped systems. The low yield of the DCCT system was probably due to the poor stand achieved after planting. The DCCT system tended to dry out after planting which may have caused some seed to die after germinating. Cheshire et al. (1985) reported similar results when double-cropping Florunner peanuts in Georgia. They found that no-till double-cropped peanuts significantly outyielded conventionally planted double-cropped peanuts.

The MCR system had a significantly higher dry pod yield in 1985 when compared with the other four peanut systems (Table II). There were no significant differences between the monocropped spanish and the double-cropped systems. Tillage seemed to have little effect upon the double-cropped systems with only 120 kg/ha separating the high and low system.

TABLE II  
EFFECT OF CROPPING SYSTEM ON YIELD, MARKET GRADE, AND  
ECONOMIC FACTORS OF PEANUTS IN 1984 AND 1985

SYSTEM	YIELD	SMK	SS	TSMK	OK	DK	TK	GROSS
	kg/ha			%				\$/ha
1984#								
DCNT+S	*2566b	52.4c	2.2c	54.5b	6.0a	0.0a	60.5c	1227b
DCNT-S	2406b	53.9bc	2.1c	56.0b	6.1a	0.1a	62.3c	1186b
DCCT	1804b	52.2c	1.6c	53.9b	6.9a	0.4a	61.0c	852b
MCS	3805a	56.7b	6.6a	63.2a	3.2b	0.2a	66.6b	2090a
MCR	4108a	63.5a	3.9b	67.4a	6.0a	0.2a	73.6a	2420a
O.S.L.@	<0.01	<0.01	<0.01	<0.01	0.18	0.20	<0.01	<0.01
%CV	17.1	4.6	24.5	4.7	29.7	141.2	3.0	16.5
1985								
DCNT+S	2783b	53.1ab	14.2ab	67.3a	3.4a	1.1a	71.8b	1633b
DCNT-S	2680b	53.9ab	14.1ab	68.0a	3.8a	0.9a	72.7ab	1593b
DCCT	2800b	54.7ab	14.8ab	69.5a	3.3a	0.4a	73.2ab	1699b
MCS	3107b	49.2b	18.8a	68.1a	2.2a	1.3a	71.6b	1828b
MCR	3646a	59.1a	9.9b	69.0a	4.8a	1.2a	74.9a	2203a
O.S.L.	<0.01	0.07	0.26	0.20	0.41	0.44	<0.01	<0.01
%CV	9.2	8.2	28.2	4.1	47.4	71.5	2.3	10.6

\*Means within each column and year followed by the same letter are not significantly different at the 0.05 level based on Duncan's Multiple Range test.

#Yields and gross returns are based on green weights in 1984.

@Observed significance level of the F-test.

## MARKET GRADE DATA

In the 1984 experiment the MCR system was significantly higher in SMK when compared with the other four systems (Table II). The MCS system was significantly higher than the DCNT+S and the DCCT in SMK but was not significantly higher than the DCNT-S system. There were no significant differences noted between any of the double-cropped systems. The higher SMK of the MCR system was primarily due to the larger seed size associated with the Florunner variety. The MCR system was significantly higher in SMK in 1985 only when compared with the MCS system (Table II). SMK of the MCS system was not statistically lower than the double-cropped systems.

Sound splits were highest in the MCS system in 1984 and it was significantly different from all other systems (Table II). The MCR system had a significantly higher SS when compared with the double-cropped systems. There were no significant differences in SS among the double-cropped systems. The higher SS for the MCS system compared with the MCR system was probably due to a varietal effect. It is common to see a higher SS in spanish types when compared with runner types. The MCS system also had the highest SS in the 1985 experiment but it was significantly higher only when compared with the MCR system (Table II). The double-cropped systems, although higher in SS, were not significantly different from the MCR system.

Percent TSMK, which is the sum of SMK and SS followed basically the same pattern as SMK in 1984. Both monocropped systems were significantly higher in TSMK than the double-cropped systems, however, the monocropped systems were not significantly different from each other (Table II). There were no significant differences among the three double-cropped systems. There were no significant differences in TSMK among any of the peanut systems in 1985 with only 2.2% separating the high and low systems (Table II).

The MCS system was significantly lower in OK than all other systems in 1984 (Table II). No significant differences were noted between the MCR system and the double-cropped systems. The lower OK of MCS is probably due to the longer growing season when compared with the double-cropped systems and a varietal effect when compared with MCR. No significant differences in OK were noted among any of the systems in 1985 (Table II). However, MCR, which requires the longest growing season, had the highest mean OK, the double-cropped systems were intermediate, and MCS had the lowest mean OK.

There were no significant differences found among any of the systems in DK in either the 1984 or 1985 experiment (Table II). The lack of significant differences was due primarily to the extremely low numbers involved and the high variation among the observations in the two studies.

In the 1984 experiment the MCR system had the highest percentage of TK which is the sum of SMK, SS, OK, and DK and was significantly better than all other systems (Table II).

The MCS system had significantly higher TK than all of the double-cropped systems, which were not significantly different from each other. The Florunner variety plus the longer growing season were likely responsible for the high TK of MCR. The advantage of MCS over the double-cropped systems was probably due to the longer growing season afforded this system. Tillage effects among the double-cropped systems were not observed. In 1985 the MCR system was significantly higher in TK than DCNT+S and the MCS system, however, it was not significantly different from DCCT or DCNT-S (Table II). No significant differences were noted among any of the spanish systems.

#### Economic Returns

In 1984, gross returns for the peanuts in the various systems were calculated based on green weights and on dollars per ton values of \$7.862 per %TSMK and \$1.40 per %OK for spanish peanuts and \$7.823 per %TSMK and \$1.40 per %OK for runner peanuts. The MCS and MCR systems had significantly higher gross returns per hectare than the double-cropped systems in 1984 (Table II). Although the MCR system grossed \$330/ha more than the MCS system, they were not significantly different. No statistically significant differences were noted among the three double-cropped systems in gross returns per hectare. Gross returns for the 1985 experiment were calculated based on dry weights and on dollars per ton values of \$7.968 per %TSMK for spanish and \$7.928 per %TSMK for

runners. Other kernels were again valued at \$1.40 per % for both market types. The MCR had the highest gross return per hectare and was significantly different from all other systems in the study (Table II). There were no significant differences among the various spanish systems.

Net returns per hectare for the 1984 study were not calculated. All production costs and returns for the 1985 experiment were recorded (TABLE III). A mean wheat yield of 2956 kg/ha (44 bu/ac) was used to calculate grain returns for the monocropped wheat and the double-cropped peanut/wheat systems.

Since many peanut farmers plant a wheat cover crop in the fall, example budgets for MCS and MCR, with a theoretical forage grazing return, were run to determine economic feasibility. Forage returns for MCS were based on March, April, and May grazing which totalled 5.8 animal unit months (AUMS). Forage returns for MCR were based on April and May grazing which totalled 4.4 AUMS due to the later planting date for the wheat in the MCR system. An example budget was also run for the MCW system. The forage returns helped both the MCS and the MCR systems achieve a better net return per hectare than the peanut only systems. The MCR system netted \$989/ha with a forage return versus \$928/ha without and the MCS system netted \$636/ha with a forage return versus \$554/ha without. Results from the 1985 study indicated that MCR

TABLE III

OPERATING COSTS, FIXED COSTS, RECEIPTS, AND NET RETURNS  
FOR THE MONOCROPPED PEANUTS, MONOCROPPED PEANUTS  
WITH A GRAZING RETURN, MONOCROPPED WHEAT, AND  
DOUBLE-CROPPED PEANUT SYSTEMS IN 1985

	DCNT+S	DCNT-S	DCCT	MCS	MCSF	MCR	MCRF	MCW
OPERATING INPUTS:				\$/ha				
Peanut seed	121	121	121	156	156	147	147	0
Wheat seed	14	14	14	9	9	14	14	9
Herbicide	159	159	99	99	99	99	99	122
Nitrogen	62	62	62	62	62	62	62	62
Phosphorous	21	21	21	21	21	21	21	21
Baling wire	0	41	0	0	0	0	0	0
Annual operating capital	14	10	13	26	21	31	28	7
Labor charges	80	89	101	83	83	83	83	33
Machinery, fuel, oil	157	171	191	135	135	135	135	81
Irrigation, fuel, oil	245	245	245	245	245	245	245	0
	---	---	---	---	---	---	---	---
Total Operating Cost	873	933	867	836	831	837	834	335
FIXED COST:								
Machinery								
Interest at 13%	114	126	144	101	101	101	101	63
Depr, taxes, ins	130	141	161	108	108	108	108	74
Irrigation								
Interest at 13%	127	127	127	127	127	127	127	0
Depr, taxes, ins	102	102	102	102	102	102	102	0
	---	---	---	---	---	---	---	---
Total Fixed Cost	473	495	534	438	438	438	438	137
RECEIPTS:								
Peanuts	1633	1593	1699	1828	1828	2203	2203	0
Wheat grain	318	318	318	0	0	0	0	318
Wheat hay	0	316	0	0	0	0	0	0
Wheat grazing	0	0	0	0	77	0	58	0
	---	---	---	---	---	---	---	---
Total Receipts	1951	2227	2017	1828	1905	2203	2261	318
Returns over TOC	1078	1294	1150	992	1074	1366	1427	-17
Net Returns	*605	799	616	554	636	928	989	-154
	b	ab	b	b	b	a	a	c

\*Means followed by the same letter are not significantly different at the 0.05 level based on Duncan's Multiple Range test.

with a grazing return was the most profitable system, however it was not significantly better than MCR without the grazing return (Table III). There were no statistically significant differences among the spanish systems, however all peanut systems were significantly higher in net returns per hectare than the monocropped wheat system which lost \$154/ha.

#### WEED CONTROL

Weed species noted in the 1984 experiment included Russian thistle (*Salsola kali* L.), redroot pigweed (*Amaranthus retroflexus* L.), prostrate spurge (*Euphorbia supina* Raf.), leafflower (*Ehlyanthus abnormas* L.), common lambsquarters (*Chenopodium album* L.), buffalobur (*Solanum elaeagnifolium* Dun.), and tumble pigweed (*Amaranthus albus* L.). No single species was dominant in the study.

In 1984, the double-cropped systems had significantly better weed control than the MCS system (Table IV). The two monocropped systems had the lowest weed control but were not significantly different from each other. Excellent weed control was achieved in the DCCT system at the time of visual estimation. The reduced weed control in the monocropped systems was probably due to the extended period of time between planting and estimation of percent control.

Weed species present in the 1985 experiment were Russian thistle (*Salsola kali* L.), redroot pigweed (*Amaranthus retroflexus* L.), prostrate spurge (*Euphorbia supina* Raf.), Carolina horsenettle (*Solanum carolinense* L.), yellow

TABLE IV

EFFECT OF CROPPING SYSTEM ON WEED CONTROL IN 1984 AND 1985,  
SOUTHERN BLIGHT INCIDENCE IN 1985, AND NORTHERN  
ROOT-KNOT NEMATODE NUMBERS IN 1985

SYSTEM	WEED CONTROL		SOUTHERN BLIGHT	NEMATODES
	1984	1985	1985	1985
	%		%	larvae/100 CC
DCNT+S	*92.5a	86.3b	2.1bc	1577a
DCNT-S	88.8a	72.5c	2.7bc	1472a
DCCT	100.0a	99.8a	1.6c	2024a
MCS	70.0b	99.5a	5.1ab	2565a
MCR	85.0ab	97.3a	6.5a	2165a
O.S.L.#	0.02	<0.01	0.03	0.31
%CV	12.5	6.8	53.3	77.1

\*Means within columns followed by the same letter are not significantly different at the 0.05 level based on Duncan's Multiple Range test.

#Observed significance level of the F-test.

nutsedge (*Cyperus esculentus* L.), carpetweed (*Molluga verticillata* L.), common morningglory (*Ipomoea purpurea* (L.) Roth), ivy leaf morningglory (*Ipomoea hederacea* (L.) Jacq.) tall waterhemp (*Amaranthus tuberculatus* L.), crabgrass (*Digitaria sanguinalis* (L.) Scop.), common lambsquarters (*Chenopodium album* L.), prickly sida (*Sida spinosa* L.), tumble pigweed (*Amaranthus albus* L.), toothed spurge (*Euphorbia senata* L.), and wooly croton (*Croton capitatus* Michx.). As in the 1984 experiment, no single species was dominant in any of the systems.

Excellent weed control was achieved in all three conventionally planted systems in 1985 and they were significantly better than the two no-till systems (Table IV). Hartzog (personal communication, 1986) also reported higher

weed numbers in reduced tillage plots, but indicated the weeds were readily controlled with herbicides. The DCNT+S system had better weed control than DCNT-S, probably because of the mulching effect of the straw that was left on DCNT+S, since less herbicide would be expected to reach the soil surface of the DCNT+S system due to the 7900 kg/ha of straw residue left on the plots.

#### Disease Incidence

The incidence of peanut diseases was virtually non-existent in the 1984 study. In 1985, Southern blight, caused by *Sclerotium rolfsii* Sacc. was the dominant disease throughout the peanut growing season, therefore the percentage of plants infected with this disease was determined for each system at its respective digging date. The MCR system had significantly more infected plants than the double-cropped systems (Table IV) but was not significantly different from MCS. The MCS system had significantly more Southern blight than DCCT but was not significantly different from the two no-till systems which were similar. Hartzog (personal communication, 1986) reported similar differences among no-till and conventionally planted peanuts in the incidence of Southern blight. Cheshire et al. (1985) also found that the presence of surface residues in no-till planted systems did not increase the incidence of Southern blight. When comparing the MCS and MCR systems, the tendency for more Southern blight in the MCR

system may have been because MCR was in the ground longer than MCS. This was also the case with the MCS system when compared with the double-cropped systems. The lower mean incidence of Southern blight noted in the DCCT system was possibly due to the fact that DCCT was clean tilled while DCNT+S and DCNT-S were planted no-till.

#### Nematode Numbers

There was no visual evidence of root galls caused by Northern root-knot nematodes in 1984, therefore populations were not determined. In the 1985 study no significant differences in nematode numbers were found among any of the peanut systems (Table IV). Mean numbers of Northern root-knot nematodes per 100cc of soil tended to be highest in the conventionally planted systems versus the no-till systems. Hartzog (personal communication, 1986), studying Florunner in Alabama, concluded that root-knot nematode numbers were not affected by tillage treatments. Although no statistical comparison was made with the MCW system, Northern root-knot nematode numbers were lower in this system. The MCW system had a mean nematode number of 3.5/100cc soil, which is dramatically lower than the rest of the systems. This may be due to the fact that nematodes require live plant material before they can reproduce (Crofton, 1966). Therefore, these numbers were not surprising because there was no live plant material on the MCW plots when the samples were taken.

## Growth Analysis Factors

There were no significant differences among the systems in the number of pegs per plant at sampling date 1 in 1984 (Table V). The peanuts in the MCR system had significantly more pegs than the DCNT-S system at date 2. The MCR system had the greatest number of pegs per plant at sampling date 3 and was statistically different from DCNT+S, DCNT-S, and MCS. The DCCT system also had significantly more pegs than MCS and DCNT-S on date 3. The MCR system had more pegs per plant than all other systems on dates 4 and 5. The DCNT-S and DCCT systems also had significantly more pegs per plant than DCNT+S and MCS on date 5. The MCR system again had significantly more pegs per plant on the last sampling date when compared with the double-cropped systems. Overall, the peanuts in the MCR system had a higher average number of pegs per plant than the other four systems. This difference is due most likely to botanical type differences (runner vs spanish). There seemed to be no consistent differences among the spanish treatments, whether double or monocropped.

There were no significant differences in peg numbers per plant from the first to the last sampling date for the DCNT+S, MCS, or MCR systems in 1984 (Table VI). The DCNT-S system had significantly more pegs per plant on the last two dates than on date 2. The DCCT system had significantly more pegs per plant at sampling date 3 than at either date 2 or 1. There were significantly fewer pegs per plant in the DCCT system at date 1 when compared with all other dates.

TABLE V

EFFECT OF CROPPING SYSTEM ON PEG AND POD NUMBERS PER PLANT,  
OVEN DRY WEIGHT PER POD, AND POTENTIAL PEANUT  
YIELDS FOR EACH SAMPLING DATE  
IN 1984 AND 1985

SYSTEM	PEG NUMBER		POD NUMBER		DRY WT./POD		POTENTIAL YIELD	
	1984	1985	1984	1985	1984	1985	1984	1985
					g/pod		kg/ha	
					Sampling date 1			
DCNT+S	34.8a	47.9a	24.6a	32.6a	0.14b	0.31b	477b	2199a
DCNT-S	39.1a	59.9a	27.4a	40.4a	0.15b	0.30b	552b	2470a
DCCT	26.0a	59.9a	17.3a	43.7a	0.16b	0.35b	336b	3289a
MCS	42.8a	56.8a	21.9a	32.6a	0.37b	0.50a	2412a	3636a
MCR	48.8a	83.3a	24.0a	48.4a	0.28ab	0.38ab	1371ab	3244a
O.S.L.#	<0.01	0.02	0.07	0.08	<0.01	<0.01	<0.01	0.13
%CV	32.9	36.3	33.8	36.6	30.1	18.4	46.6	46.7
					Sampling date 2			
DCNT+S	45.0ab	43.6a	31.7a	32.4a	0.26a	0.51ab	1135a	3210a
DCNT-S	30.1b	58.5a	23.1a	41.2a	0.21a	0.50ab	652a	4626a
DCCT	39.1ab	50.0a	24.0a	32.9a	0.24a	0.53ab	631a	3560a
MCS	43.5ab	55.1a	23.5a	41.6a	0.41a	0.65a	2705a	5967a
MCR	85.2a	54.8a	44.2a	33.6a	0.30a	0.44b	2965a	2556a
O.S.L.	<0.01	0.64	0.01	0.38	<0.01	<0.01	<0.01	0.02
%CV	48.6	43.6	51.1	39.1	23.5	21.7	71.6	57.0
					Sampling date 3			
DCNT+S	50.4bc	71.0a	36.6ab	50.7a	0.35ab	0.51a	1789b	5225a
DCNT-S	41.3c	57.3a	28.3b	38.5a	0.33b	0.61a	1225b	4787a
DCCT	66.4ab	49.4a	40.1ab	33.6a	0.37ab	0.55a	1602b	3708bc
MCS	41.4c	59.5a	26.1b	35.2a	0.51a	0.57a	4036a	4307ab
MCR	77.8a	56.7a	52.8a	37.5a	0.35ab	0.49a	3594a	3151c
O.S.L.	<0.01	0.38	<0.01	0.04	<0.01	<0.01	<0.01	0.02
%CV	32.9	40.4	31.9	32.9	12.9	13.6	34.0	34.7
					Sampling date 4			
DCNT+S	46.1b	52.5ab	34.9ab	38.4ab	0.42b	0.57a	1924b	4506b
DCNT-S	50.0b	45.7b	39.6a	31.6b	0.45ab	0.61a	2390ab	3958b
DCCT	49.8b	46.2b	35.2ab	29.6b	0.43b	0.60a	1674b	3642b
MCS	30.2b	50.5ab	20.2b	41.7a	0.58a	0.66a	3784a	5968a
MCR	73.9a	67.4a	47.4a	45.1a	0.41b	0.56a	3479a	4449b
O.S.L.	<0.01	<0.01	<0.01	0.01	<0.02	0.21	<0.01	0.02
%CV	38.0	27.0	34.6	28.7	20.7	15.0	38.1	34.9

TABLE V (Continued)

SYSTEM	PEG NUMBER		POD NUMBER		DRY WT./POD		POTENTIAL YIELD	
	1984	1985	1984	1985	1984	1985	1984	1985
					g/pod		kg/ha	
					Sampling date 5			
DCNT+S	37.5c	42.8a	31.0c	30.2a	0.61ab	0.60a	2545c	3584a
DCNT-S	61.4b	35.9a	40.6b	29.1a	0.58ab	0.69a	3088bc	4014a
DCCT	55.2b	36.4a	39.2bc	30.7a	0.51b	0.63a	2201c	4079a
MCS	30.9c	-----	21.3d	-----	0.69a	-----	4563ab	-----
MCR	74.7a	59.3a	54.2a	42.0a	0.52b	0.66a	5350a	4759a
O.S.L.	<0.01	0.03	<0.01	0.15	<0.01	0.44	<0.01	0.54
%CV	34.0	43.6	34.0	42.3	16.8	18.3	34.8	43.6
					Sampling date 6			
DCNT+S	45.8b	-----	36.6ab	-----	0.72a	-----	3388ab	-----
DCNT-S	61.0b	-----	41.2ab	-----	0.66a	-----	3693ab	-----
DCCT	49.6b	-----	31.2b	-----	0.71a	-----	2302b	-----
MCS	-----	-----	-----	-----	-----	-----	-----	-----
MCR	79.5a	-----	48.9a	-----	0.68a	-----	6345a	-----
O.S.L.	<0.01	-----	0.02	-----	0.65	-----	<0.01	-----
%CV	35.2	-----	30.7	-----	15.3	-----	28.1	-----

\*Means within each column and sampling date followed by the same letter are not significantly different at the 0.05 level based on Duncan's Multiple Range test.

#Observed significance level of the F-test.

TABLE VI

EFFECT OF SAMPLING DATE ON PEG AND POD NUMBERS PER PLANT,  
OVEN DRY WEIGHT PER POD, AND POTENTIAL PEANUT  
YIELDS FOR EACH CROPPING SYSTEM  
IN 1984 AND 1985

SAMPLING DATE	PEG NUMBER 1984	PEG NUMBER 1985	POD NUMBER 1984	POD NUMBER 1985	DRY WT./POD 1984	DRY WT./POD 1985	POTENTIAL YIELD 1984	POTENTIAL YIELD 1985
					g/pod		kg/ha	
					DCNT+S			
1	*34.8a	47.9b	24.6a	32.6ab	0.14c	0.31b	477d	2196c
2	45.0a	43.6b	31.7a	32.4ab	0.26bc	0.51a	1135cd	3210bc
3	50.4a	71.0a	36.6a	50.7a	0.35b	0.51a	1789bc	5525a
4	46.1a	52.5ab	34.9a	38.4ab	0.42b	0.57a	1924bc	4506ab
5	37.5a	42.8b	31.0a	30.2b	0.61a	0.60a	2545ab	3584bc
6	45.8a	-----	36.6a	-----	0.72a	-----	3388a	-----
O.S.L.#	0.11	<0.01	0.12	<0.01	<0.01	<0.01	<0.01	<0.01
%CV	31.2	27.7	32.4	27.0	20.0	17.6	31.8	31.7
					DCNT-S			
1	39.1ab	59.9a	27.5a	40.4a	0.15d	0.30c	552c	2470b
2	30.1b	58.5a	23.1a	41.2a	0.21d	0.51b	652c	4627a
3	41.3ab	57.3a	28.3a	38.5a	0.33c	0.61ab	1225bc	4787a
4	50.0ab	45.7a	39.6a	31.6a	0.45b	0.61ab	2390abc	3958ab
5	61.4a	35.9a	40.6a	29.1a	0.58a	0.69a	3088ab	4014ab
6	61.0a	-----	41.2a	-----	0.66a	-----	3693a	-----
O.S.L.	<0.01	0.03	<0.01	0.13	<0.01	<0.01	<0.01	0.56
%CV	39.2	37.2	31.3	34.8	17.3	16.7	37.9	46.0
					DCCT			
1	26.0c	59.9a	17.3b	43.7a	0.16d	0.35b	336c	3287a
2	39.1bc	50.0a	24.0ab	32.9a	0.24cd	0.53ab	631c	3560a
3	66.4a	49.4a	40.1a	33.6a	0.37bc	0.55ab	1602b	3708a
4	49.8ab	46.2a	35.2a	29.6a	0.43b	0.60a	1674b	3642a
5	55.2ab	36.4a	39.2a	30.7a	0.51b	0.63a	2201a	4079a
6	49.6ab	-----	31.2ab	-----	0.71a	-----	2302a	-----
O.S.L.	<0.01	0.10	<0.01	0.12	<0.01	<0.01	<0.01	0.86
%CV	38.4	38.4	38.3	37.1	19.8	18.4	42.1	43.1
					MCS			
1	42.8a	56.8a	21.9a	32.6a	0.37c	0.50a	2412c	3636a
2	43.5a	55.1a	23.5a	41.6a	0.41bc	0.65a	2705bc	5967a
3	41.4a	59.5a	26.1a	35.2a	0.51abc	0.59a	4036ab	4307a
4	30.2a	50.5a	20.2a	41.7a	0.58ab	0.66a	3479abc	5968a
5	30.9a	-----	21.3a	-----	0.69a	-----	4563a	-----
O.S.L.	0.02	0.90	0.31	0.39	<0.01	<0.01	<0.01	0.08
%CV	29.7	49.2	28.8	37.8	19.9	16.5	33.1	47.6

TABLE VI (Continued)

SAMPLING DATE	PEG NUMBER		POD NUMBER		DRY WT./POD		POTENTIAL YIELD	
	1984	1985	1984	1985	1984	1985	1984	1985
					g/pod		kg/ha	
				MCR				
				---				
1	48.8a	83.3a	24.0a	48.4a	0.28d	0.38c	1371b	3244ab
2	85.2a	54.8a	44.2a	33.6a	0.30c	0.44bc	2965ab	2556b
3	77.8a	56.7a	52.8a	37.5a	0.35bc	0.49abc	3594ab	3151ab
4	73.9a	67.4a	47.4a	45.1a	0.41bc	0.56ab	3784ab	4449a
5	74.7a	59.3a	54.2a	42.0a	0.52ab	0.66a	5350a	4759a
6	79.5a	-----	48.9a	-----	0.60a	-----	6345a	-----
O.S.L.	0.02	0.07	<0.01	0.29	<0.01	<0.01	<0.01	<0.01
%CV	37.3	37.0	39.0	39.5	17.7	17.9	40.3	44.1

\*Means within each column and cropping system followed by the same letter are not significantly different at the 0.05 level based on Duncan's Multiple Range test.

#Observed significance level of the F-test.

Regression coefficients for peg numbers per plant over the sampling period were determined using multiple regression techniques. All regression figures show a standard error of the estimate of the coefficients (SE) for the three double-cropped systems and the MCR system. MCS has its own SE due to its earlier harvest date in both years. Figure 1 shows that peg number per plant intercepts ( $b_0$ ) were significantly different with MCR being the highest. The linear coefficients ( $b_1$ ) were statistically different, however the quadratic terms ( $b_2$ ) were not significantly different. The DCNT-S system was the only system to show a steady increase in peg numbers per plant when regressed over the sampling period (Figure 1). Systems MCR, DCNT+S, and DCCT showed a curvilinear response and peaked between dates 4 and 5 which was approximately 125 DAP for the MCR system and 90 DAP for the double-cropped spanish systems (Table VII). The MCS system showed a near linear decline over the sampling period. McCloud (1974) found Florunner peg numbers to peak and then steadily decline in a study conducted in Florida although he did not mention what caused these declines. The decline in peg numbers over time may be due to sampling error because Smith (1954) reported that pegs and pods which failed to reach maturity were not eliminated by abscission but remained attached to the plant until very late in the growing season.

There were no significant differences among cropping systems in 1985 over the first three sampling dates in peg numbers per plant (Table V). The MCR system had

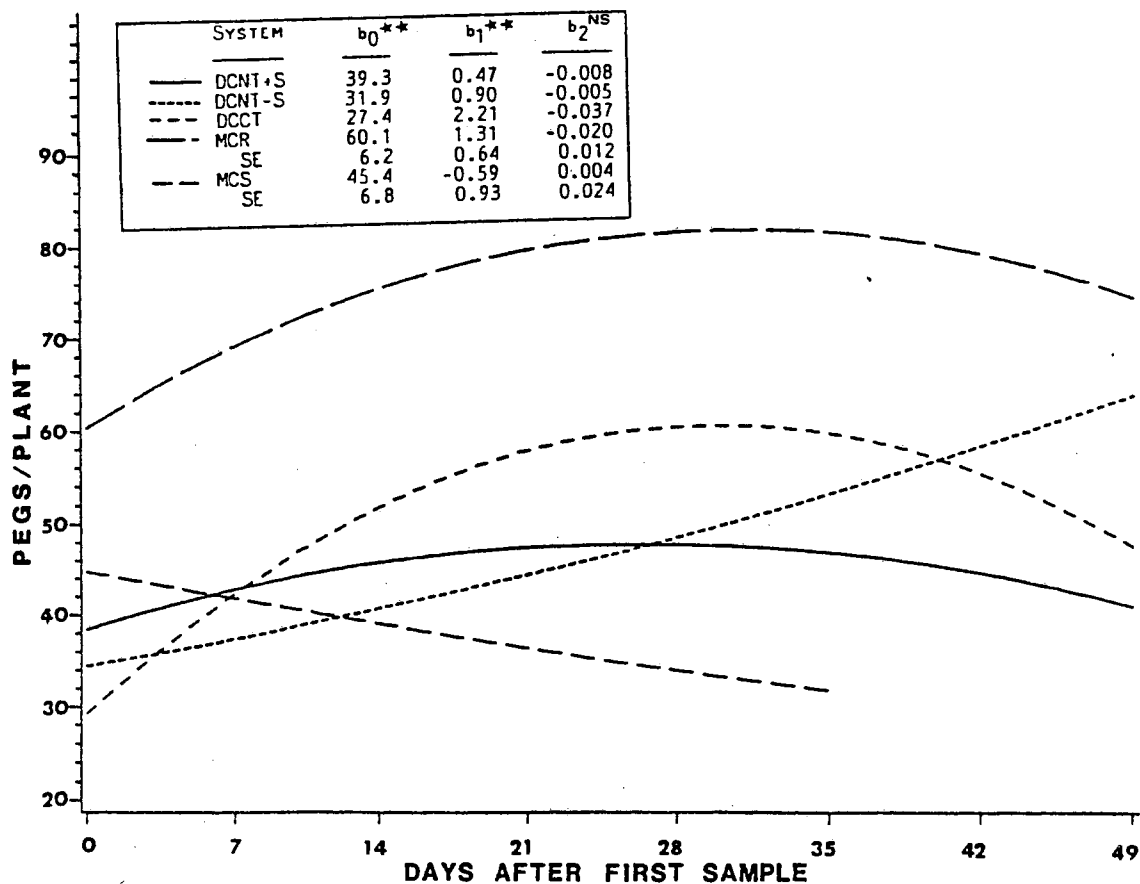


Figure 1. Regression of pegs per plant over the sampling period in 1984. \*\*, Significant at 0.01. NS, Not significantly different at 0.05.

TABLE VII

SAMPLING DATES AND CORRESPONDING CALENDAR  
DATES, DAYS AFTER PLANTING, AND DAYS  
AFTER FIRST SAMPLE FOR THE 1984  
AND 1985 GROWTH ANALYSIS STUDY

SAMPLING CALENDAR		DAP SYSTEM		DAYS AFTER
DATE	DATE	1,2,3	4#,5	FIRST SAMPLE
-----				
1984				
-----				
1	Aug. 29	62	97	--
2	Sept. 5	69	104	7
3	Sept. 12	76	111	14
4	Sept. 19	83	118	21
5	Oct. 3	97	132	35
6	Oct. 17	111	146	49
1985				
-----				
1	Sept. 3	74	103	--
2	Sept. 10	81	110	7
3	Sept. 24	95	124	21
4	Oct. 8	109	138	35
5	Oct. 22	123	152	49
-----				
#Sampled five times in 1984 and four times in 1985.				

significantly more pegs than DCCT and DCNT-S on sampling date 4. There were no significant differences among systems on the last sampling date. DCNT+S had significantly more pegs on date 3 than on dates 1, 2, or 5 (Table VI). Both DCNT-S and DCCT had a steady decline in peg numbers throughout the sampling period, however they were not significantly different at any of the dates. The two monocropped systems showed no clear pattern for peg additions or loss throughout the sampling period.

Regression analysis indicated intercepts of the various systems were significantly different, however the linear and quadratic coefficients were not (Figure 2). The DCCT system had a near linear decline in peg numbers per plant when regressed over the sampling period. All other systems showed a curvilinear response with a peak around 14 to 21 days after the first samples were taken except for the MCR system which was at its lowest peg number per plant around this same time. It then increased slightly between dates 4 and 5.

There were no significant differences among cropping systems in the number of pods per plant on the first two sampling dates in 1984 (Table V). The MCR system had significantly more pods per plant than DCNT-S and MCS on date 3. DCNT-S showed a dramatic increase in the number of pods per plant at sampling date 4. The DCNT-S system and the MCR system had significantly more pods per plant than MCS. The MCR system had significantly more pods per plant than all other systems at sampling date 5. The DCNT-S system was significantly better than DCNT+S and MCS which were significantly different from each other. On date 6 the MCR system was significantly different only when compared with the DCCT system. Except for the first date, MCR had the most pods per plant. This was probably because Florunner had more pegs per plant and the fact that it has a prostrate growth habit which allows more pegs to penetrate the soil and produce pods. There were no consistent differences among the double-cropped or monocropped spanish treatments.

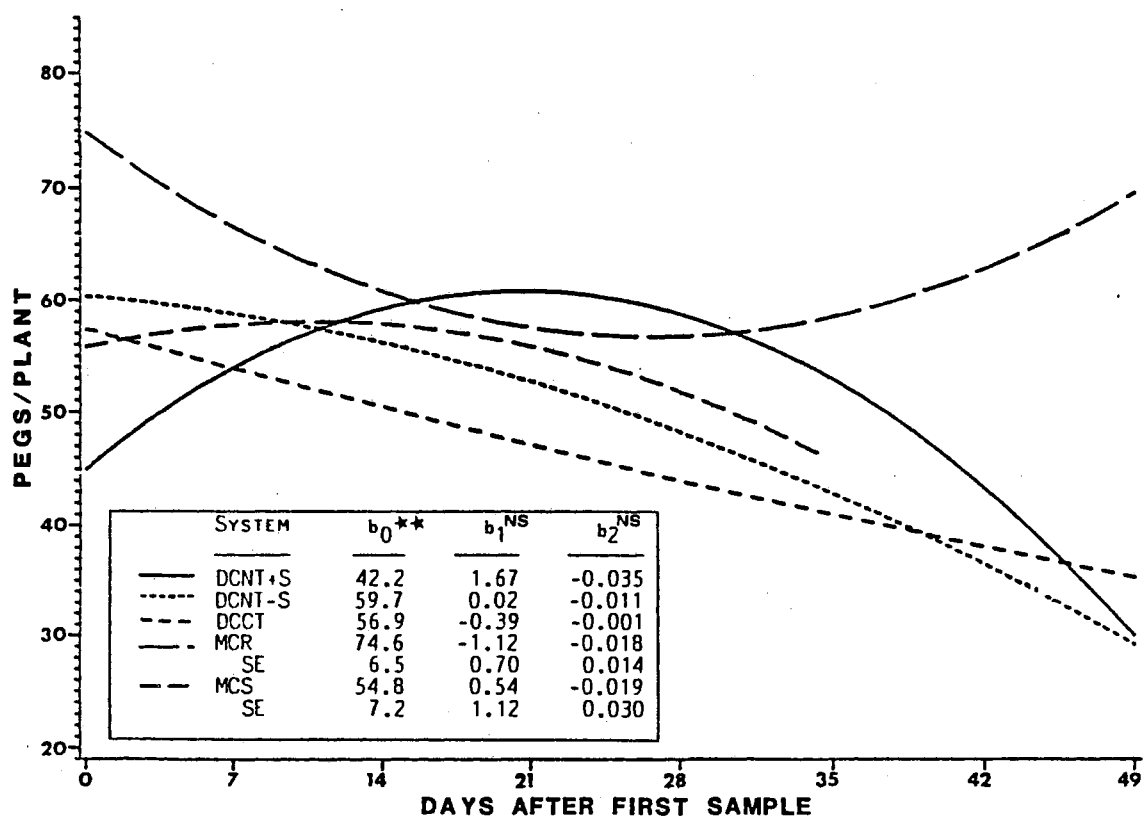


Figure 2. Regression of pegs per plant over the sampling period in 1985. \*\*, Significant at 0.01. NS, Not significantly different at 0.05.

There were no significant differences in pod number per plant among the sampling dates for the DCNT+S, DCNT-S, MCS, or MCR systems in 1984 (Table VI). The DCCT system had significantly more pods per plant on sampling dates 3, 4, and 5 but only when compared with date 1.

The system intercepts for pod number per plant in 1984 were significantly different, however as in the peg number per plant regression, there were no significant differences among the five cropping systems in their rate of pod initiation and/or loss in 1984 (Figure 3). The DCNT-S system was the only system that showed a steady increase in pod numbers per plant. The MCR and DCCT systems were highly curvilinear, peaking between 25 and 35 days after the first sampling date. The DCNT+S was also curvilinear and peaked around the 28th day after the first sample was taken. The MCS system had a slight peak 14 days after the first sample was taken and declined steadily thereafter. There were no significant differences among the cropping systems in the number of pods per plant in 1985 except for sampling date 4 (Table V). The two monocropped systems were significantly higher than the DCNT-S system and the DCCT system. DCNT+S was the only system that had significant differences in pod numbers per plant throughout the sampling period (Table VI). DCNT+S had significantly more pods on sampling date 3 when compared with the last sampling date.

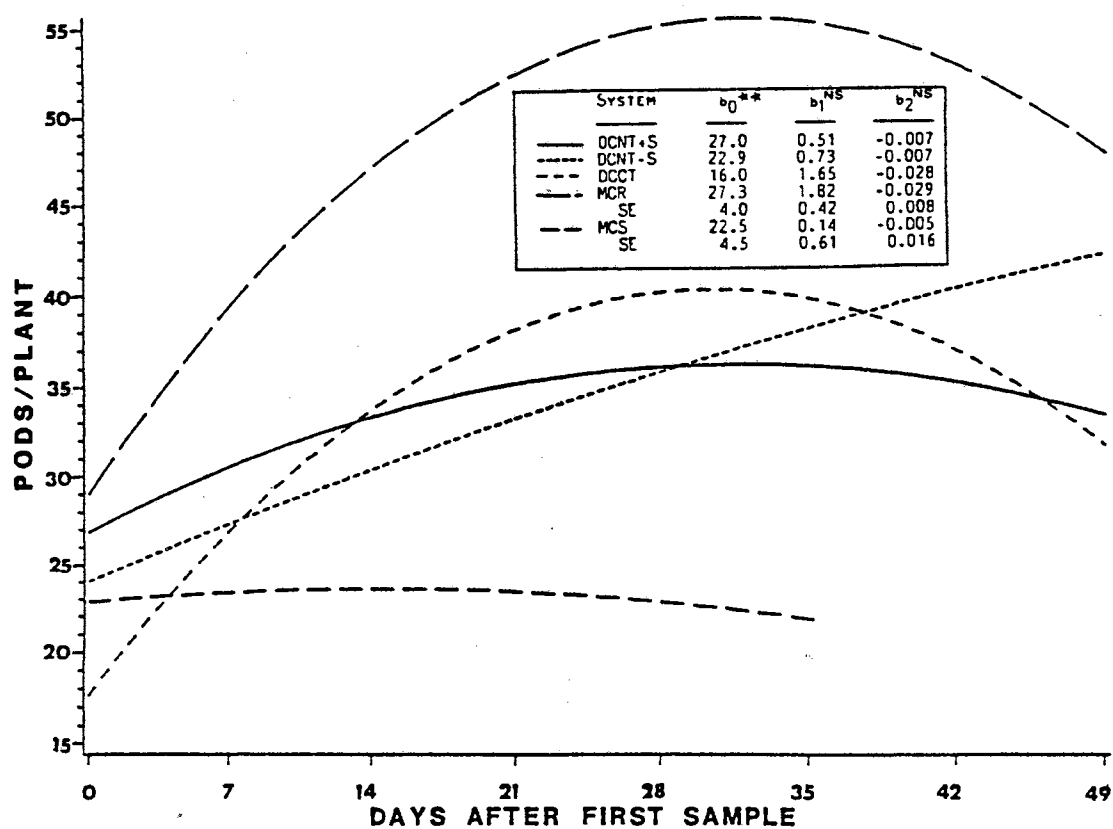


Figure 3. Regression of pods per plant over the sampling period in 1984. \*\*, Significant at 0.01. NS, Not significantly different at 0.05.

There were no significant differences among systems in their intercepts or rates of pod initiation or loss in 1985 (Figure 4). The MCS system was the only system which showed a steady increase in pod numbers per plant when regressed over the sampling period. The DCNT-S system showed a near linear decrease in pod numbers per plant over the sampling period. The MCR and DCCT systems lost pods through sample date 4 and then slowly added pods over the next two weeks. DCNT+S had the highest rate of pod initiation and loss. The loss of pods associated with the various systems may have been caused by many things including soil-borne diseases, insects, or the germination of peanuts still in the ground when they are nearing maturity.

The MCS system in 1984 had a significantly higher dry weight per pod than the double-cropped systems on date 1 (Table V). This is probably because MCS was planted 35 days earlier than the double-cropped systems (Table VII). There were no differences among cropping systems on sampling date 2. On sampling date 3 MCS was significantly higher when compared with DCNT-S. However, on date 4 it was significantly higher in dry weight per pod when compared with DCCT, DCNT+S, and MCR. At sampling date 5, MCS was significantly higher in dry weight per pod than MCR and DCCT but was not significantly higher than the two no-till planted systems. There were no differences in dry weight per pod among the cropping systems on the last sampling date. As can be seen, the MCS system had achieved a higher weight per pod

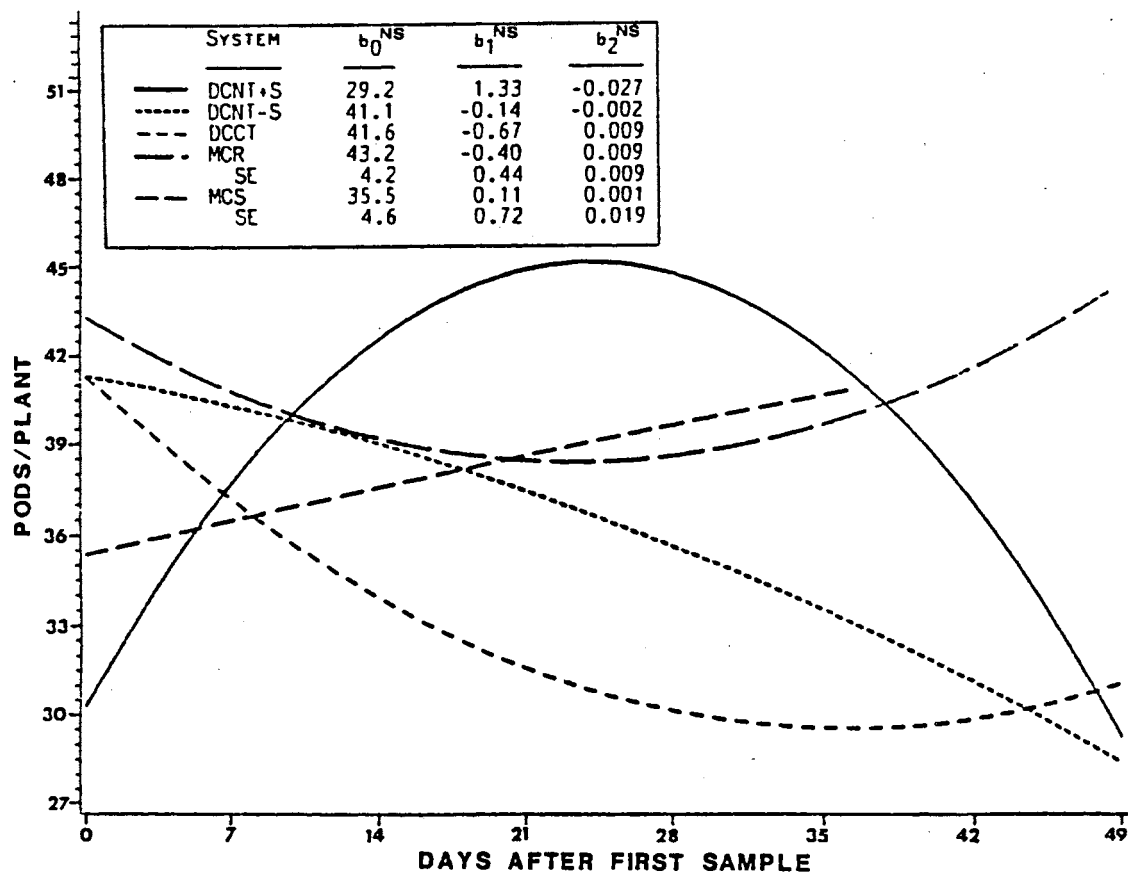


Figure 4. Regression of pods per plant over the sampling period in 1985. NS, Not significantly different at 0.05.

than the other systems when the sampling began and maintained this advantage throughout the sampling period. This was probably because it was planted 35 days earlier (Table VII) when compared with the double-cropped systems and the earlier flowering and subsequent pegging advantage of spanish peanuts over runner peanuts (MCS vs MCR). All systems increased in dry weight per pod from the first to the last sampling dates (Table VI). The double-cropped systems increased in dry weight per pod by approximately five fold over the sampling dates. The MCR system had a 2.5 fold increase while the MCS system increased only 1.8 fold from the first to the last sampling date, primarily because the MCS pods were further developed when sampling began.

The rate of dry matter accumulation per pod per day in 1984 was linear over the sampling period for all systems (Figure 5). Schenck (1961), studying Dixie Spanish, also found that the rate of increase in dry weight per pod appeared to be steady until maturity; development then appeared to cease quite rapidly. Regression analysis showed the intercepts and their rates per day to be significantly different among the cropping systems (Figure 5). The DCNT+S system had the highest rate of pod dry matter accumulation with 11.8 mg/pod/day. Tillage in the double-cropped systems seemed to have little effect upon the rate of dry matter accumulation per pod per day. All double-cropped systems had higher rates per day than either of the monocropped systems.

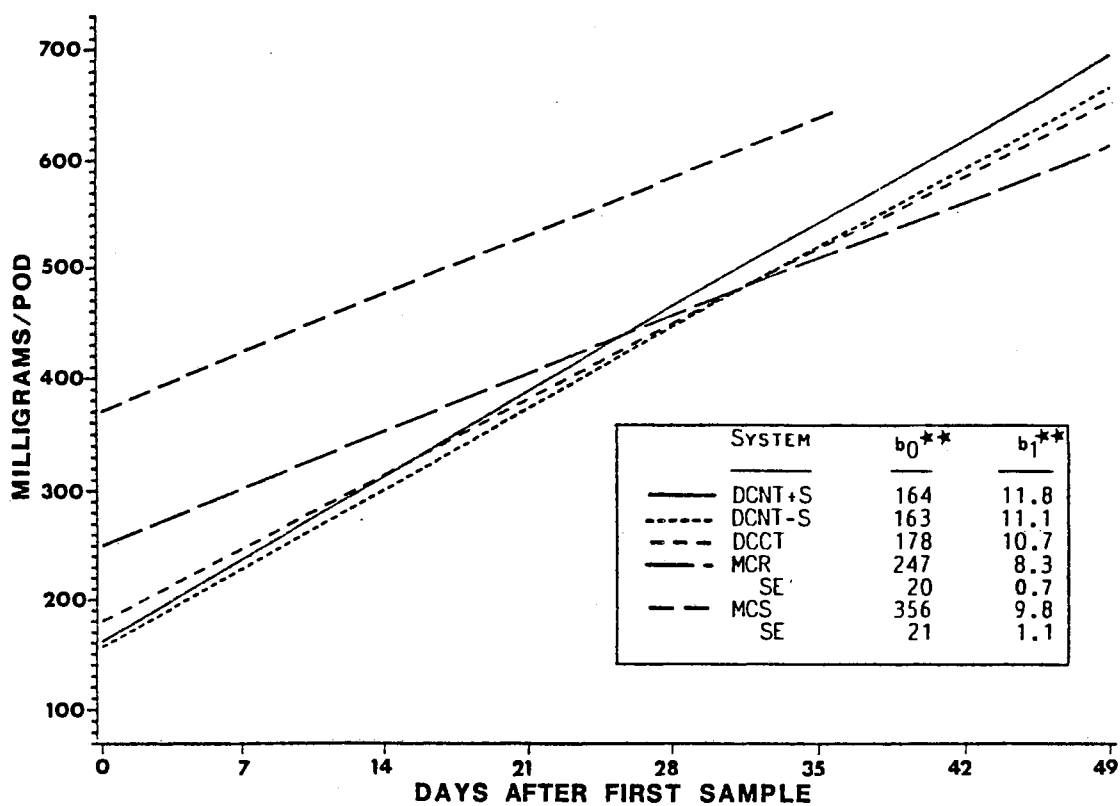


Figure 5. Regression of oven dry weight per pod over the sampling period in 1984. \*\*, Significant at 0.01.

Figure 6 illustrates the minimum and maximum temperatures that occurred throughout the 1984 sampling period. As can be seen, temperatures were steadily declining throughout the sampling period. A temperature of 0 degree C occurred approximately four days before the fifth sampling date which severely damaged the upper leaves of all peanut plants. However, pod growth continued at a steady rate over the next two weeks. Shear and Miller(1955), studying Jumbo Runners in Virginia, found exactly the opposite and concluded that there was a close correlation between decreasing mean temperature and pod growth rate. This continued increase in pod dry weight after the frost occurred might be due to several things. One possible explanation might be that the lower undamaged leaves increased their photosynthetic capacity. This seems unlikely, however, because they were shaded by the upper leaves. Another possibility might be the translocation of nutrients from the damaged leaves and/or stems to the pods. One other reason could have been because the pods were unable to utilize all the photosynthates available to them before the leaves were damaged. The assumed reduction in photosynthates due to the frost damaged leaves may still have been adequate or above levels that the pods could utilize. These results seem to imply that cooler temperatures encountered in the fall may not be as detrimental to pod growth as earlier believed.

The MCS system in 1985 had a significantly higher dry weight per pod than the double-cropped systems on sampling

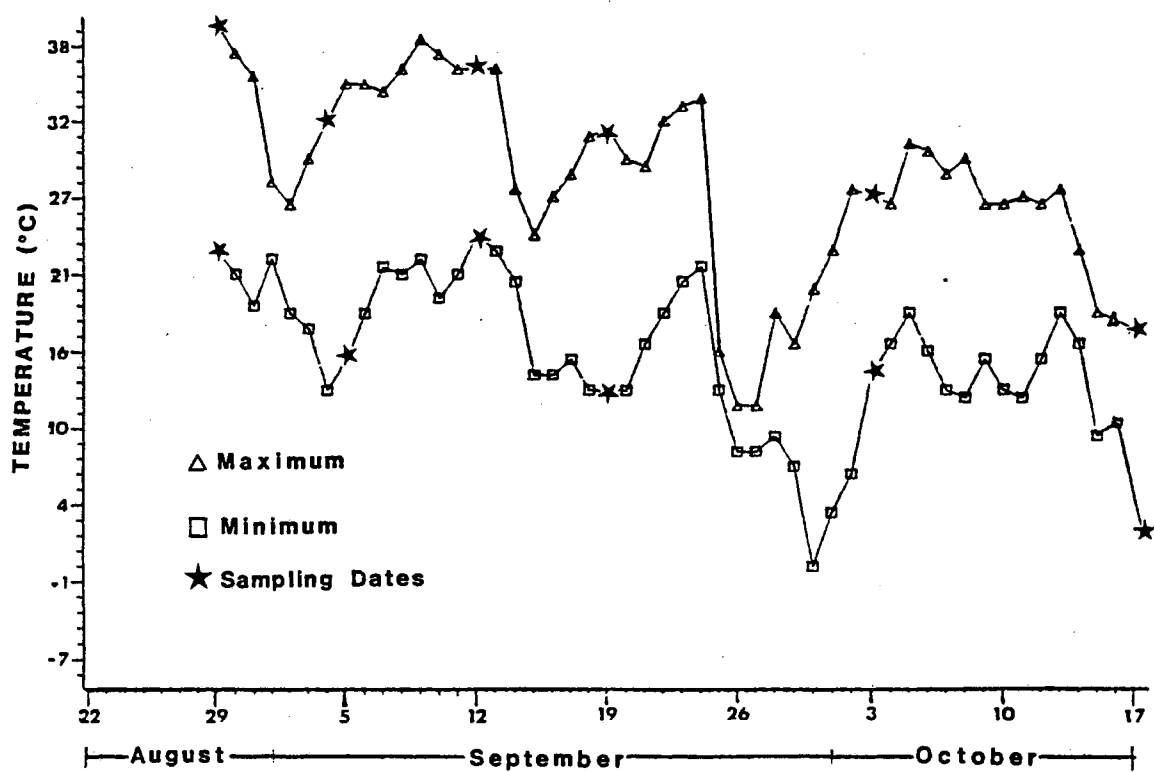


Figure 6. Daily minimum and maximum temperatures during the sampling period in 1984.

date 1 (Table V). This was probably because it was planted 29 days earlier than the double-cropped systems (Table VII). The double-cropped treatments showed a dramatic increase in dry weight per pod and surpassed the MCR system on date 2. The MCS system was significantly higher than the MCR system on sampling date 2. There were no significant differences among systems at sampling dates 3, 4, and 5.

The MCR system and the double-cropped systems had approximately a two fold increase in dry weight per pod throughout the sampling period (Table VI). This is not as high an increase as was found in 1984, however sampling was started approximately one to two weeks later in 1985. Although dry weight per pod for the MCS system increased over the sampling period, the weights at the various sampling dates were not statistically different.

All systems had a linear increase in dry matter accumulation per pod over the sampling period, however the linear coefficients of the lines were not significantly different (Figure 7). The intercepts were significantly different with MCS being the highest when sampling started. The DCNT-S system was found to have the highest rate of dry matter accumulation per pod per day with a rate of 6.6 mg/pod/day. Boote (1976) reported that Florunner pods set during the first four weeks of pegging had similar linear growth rates (33.5 mg/day) between one and seven weeks after peg penetration and accounted for 78% of the 5450 kg/ha yield at 133 days.

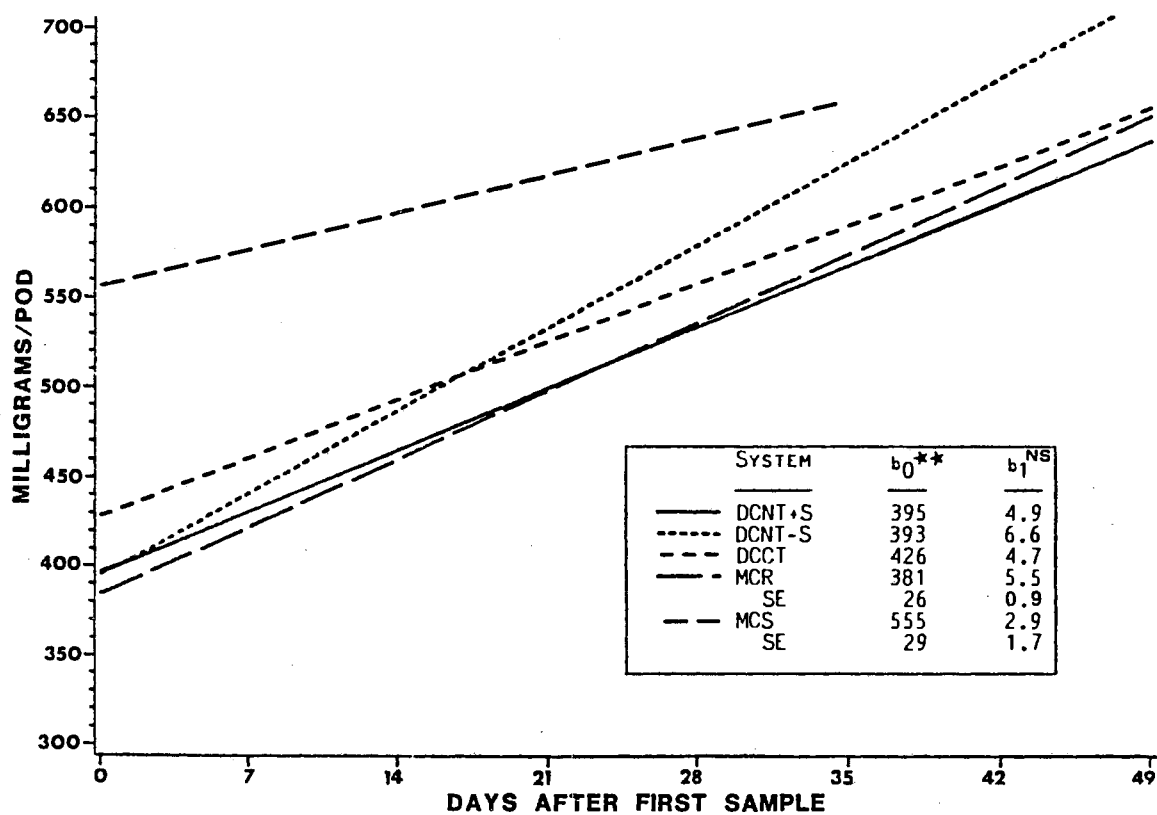


Figure 7. Regression of oven dry weight per pod over the sampling period in 1985. \*\*, Significant at 0.01. NS, Not significantly different at 0.05.

Figure 8 illustrates the steady decline in minimum and maximum temperatures throughout the sampling period in 1985. These declines are similar to those noted in 1984, although no freezing temperatures were recorded during the 1985 growing season. All systems showed a steady increase in dry weight per pod throughout this period (Figure 7). These results along with the results from the 1984 study seem to show that cooler temperatures encountered in the fall may not slow or stop peanut dry matter accumulation.

A potential pod yield per hectare in 1984 was calculated for each observation at each sampling date using the formula given in the materials and methods. The MCS system had a significantly higher potential yield at sampling date 1 when compared with the double-cropped systems (Table V). There were no differences among systems on date 2. Both MCS and MCR had a significantly higher potential yield than the double-cropped systems on sampling date 3. On sampling date 4 the monocropped systems were higher than the double-cropped systems although not significantly higher than DCNT-S. The MCR system was significantly higher than the three double-cropped systems on date 5, however, it was not significantly higher than the MCS system which was not significantly different from DCNT-S. There were no differences among the double-cropped systems. On date 6, MCR was significantly higher only when compared with the DCCT system. These results clearly show the potential advantage of early planting. The double-cropped systems were not significantly

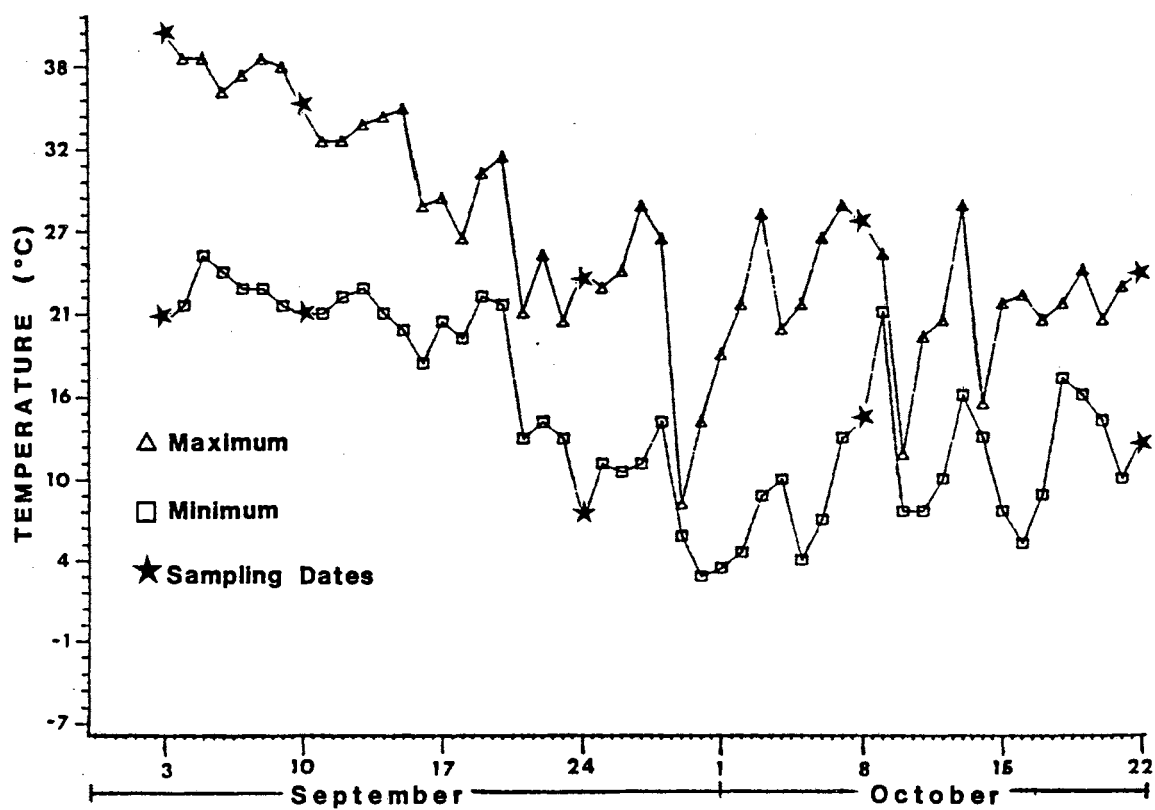


Figure 8. Daily minimum and maximum temperatures during the sampling period in 1985.

different from each other at any of the sampling dates, however, the DCCT system had the lowest potential yield at all sampling dates except date 3. The lower potential yields of DCCT were probably due to the fact that DCCT had a lower rate of dry matter accumulation coupled with a lower plant population per hectare.

All systems showed an increase in potential yield during the sampling period except MCS (Table VI). All double-cropped systems had approximately a seven fold increase in potential yield from the first to the last sampling date. The MCR system only doubled its estimated potential yield during the sampling period.

Regression analysis of potential yields per hectare in 1984 showed the intercepts and slopes of the lines for the different systems to be significantly different (Figure 9). The MCR system had the highest rate of pod dry matter accumulation per hectare per day. Duncan et. al. (1978) reported pod growth rates for Florunner and Spancross of 95.0 and 63.7 kg/ha/day, respectively. Senthong (1979) reported the pod growth rate for Florunner to be 59 kg/ha/day in a growth analysis study in Florida. Although the MCR system had the lowest rate of dry matter accumulation per pod per day, it had more pods per plant than the other systems and this more than offset the higher rate of dry matter accumulation per pod per day advantage of the spanish systems. This suggests that spanish peanut yields may be improved by selecting peanuts with a larger fruiting capacity

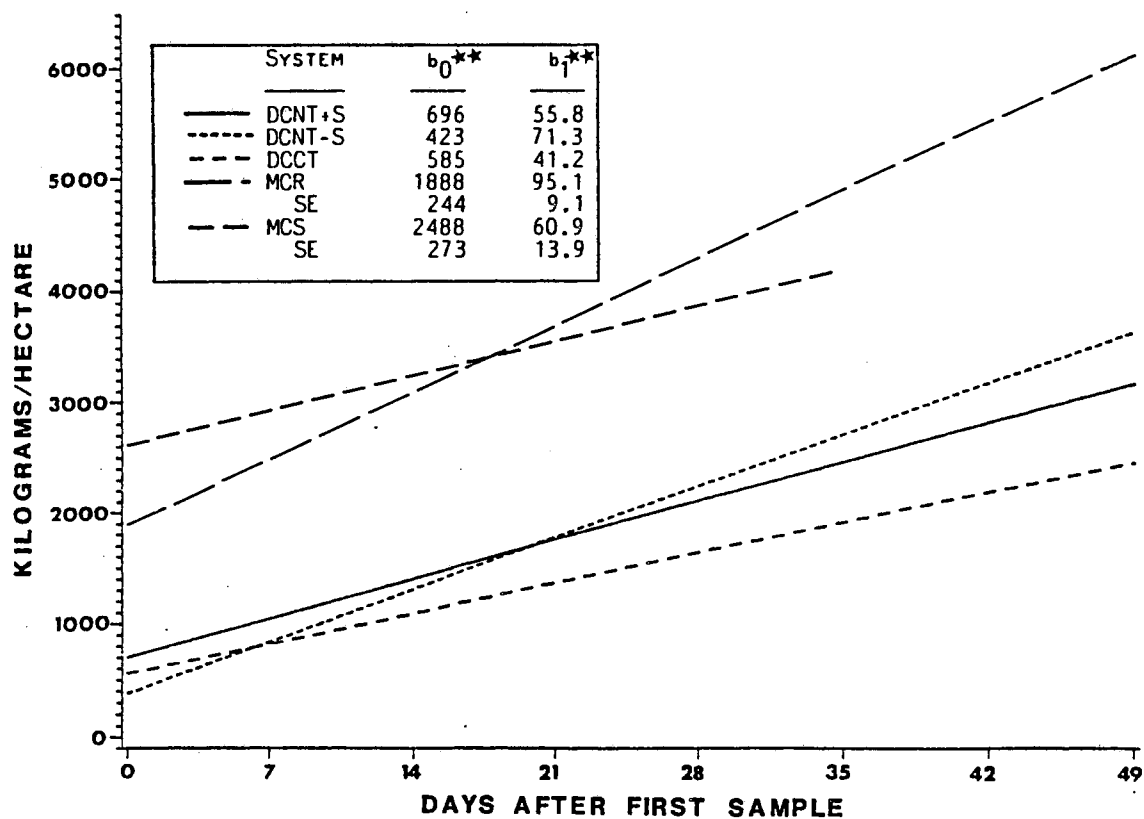


Figure 9. Regression of potential yield over the sampling period in 1984. \*\*, Significant at 0.01.

in terms of pod numbers while trying to maintain their rate of dry matter accumulation per pod per day advantage.

No significant differences were detected among systems in their potential dry pod yield per hectare in 1985 on sampling dates 1, 2, and 5 (Table V). The two no-till double-cropped systems had a higher potential yield than DCCT or MCR on date 3. The MCS system had a significantly higher potential yield than all other systems on sampling date 4. The DCNT+S, DCNT-S, and the MCR systems had significant differences in their predicted potential yields over the sampling dates in 1985 (Table VI). Although the DCCT and MCS systems were calculated to have considerably different potential yields from one date to the next, these differences were not statistically significant.

None of the systems had a steady linear increase in their potential yield over time in 1985, therefore a quadratic equation was used to find the relationship between potential yield and time. This non-linear increase may have been because of the smaller range in dry weight per pod over the sampling period and the dramatic pod losses that occurred in the no-till double-cropped systems in 1985. Regression analysis of potential yields per hectare for the various systems showed their intercepts and quadratic coefficients to be significantly different (Figure 10). The two no-till double-cropped systems were highly curvilinear when regressed over time. These highly curvilinear responses for the no-till double-cropped systems were probably due to the large

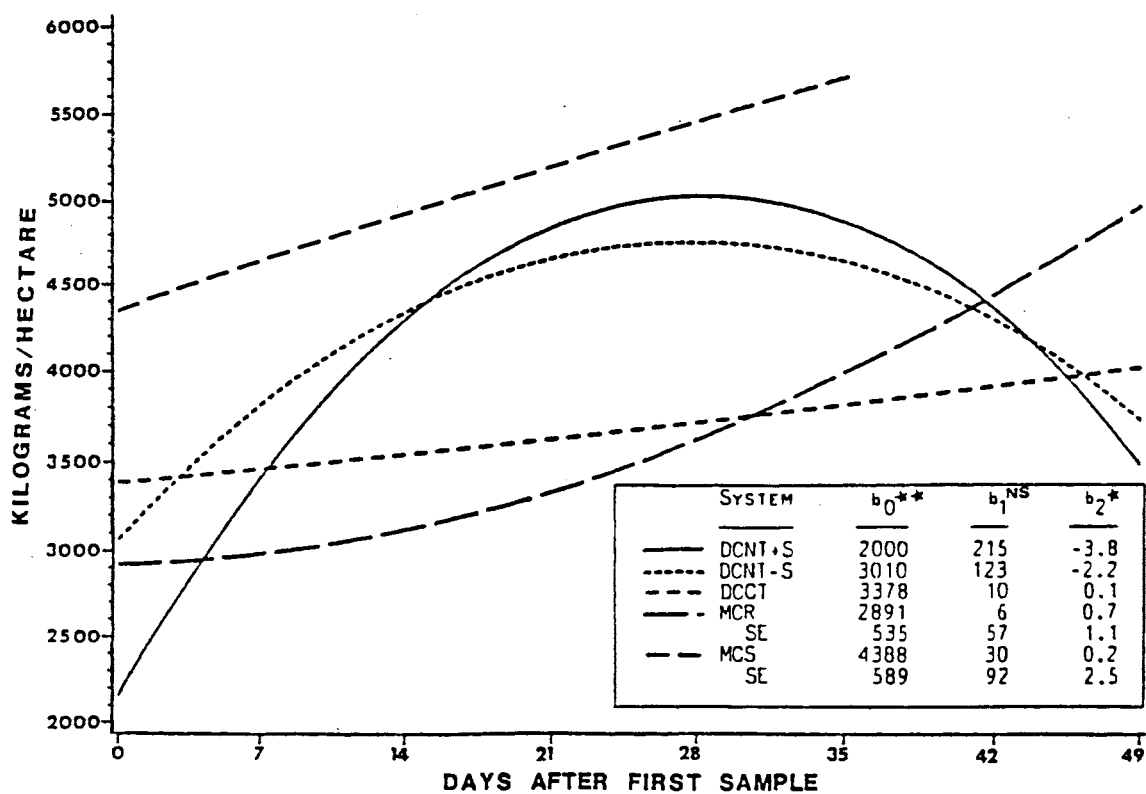


Figure 10. Regression of potential yield over the sampling period in 1985. \*, \*\*, Significant at 0.05 and 0.01 respectively. NS, Not significantly different at 0.05.

loss of pods and the smaller increase in dry weight per pod over the last two sampling dates. All other systems had a steady increase in pod dry matter per hectare per day.

#### Growth Analysis Relationships

The relationship between peg and pod numbers per plant in 1984 is shown in Figure 11. MCS was the only system which had a steady increase in the percentage of pegs with pods over the sampling period. The other four systems had slight increases or decreases from one sampling date to the next. Approximately 70% of all pegs in the double-cropped systems had pods when sampling started 62 DAP compared with approximately 50% for the monocropped systems which were sampled first at 97 DAP. This suggests that the double-cropped systems probably produced only one large flush of flowers compared with the monocropped systems which probably had time to produce multiple flushes of flowers. McCloud (1974) reported that flowering did not limit pod yields for Florunner and at harvest there were 15 pegs/plant which were unfilled. The harvest yield was 4680 kg/ha and the unfilled pegs gave a yield potential of 6940 kg/ha. He suggested that the photosynthetic sink seemed adequate for a much higher yield.

Figure 12 shows the relationships between peg and pod numbers per plant on the various sampling dates in 1985. MCR was the only system which exhibited a somewhat steady

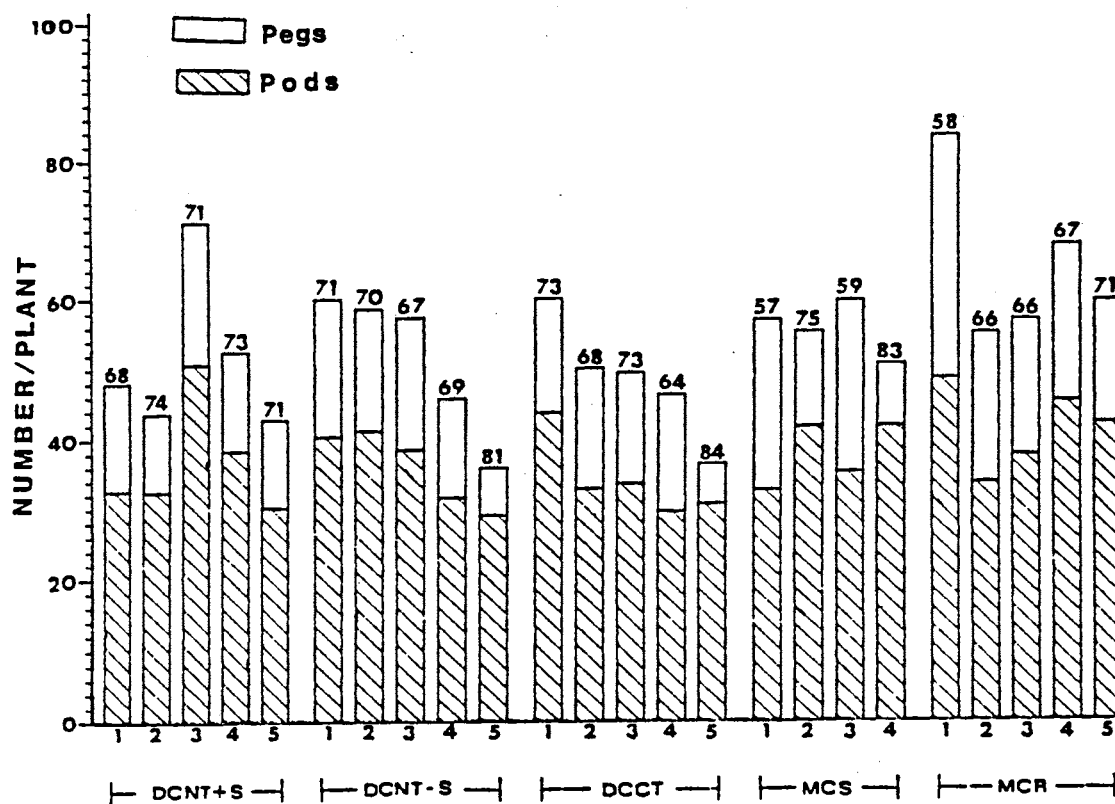


Figure 12. Relationship between peg and pod number per plant for each cropping system at each sampling date in 1985. (Number at top of bar represents the percentage of pegs with pods)

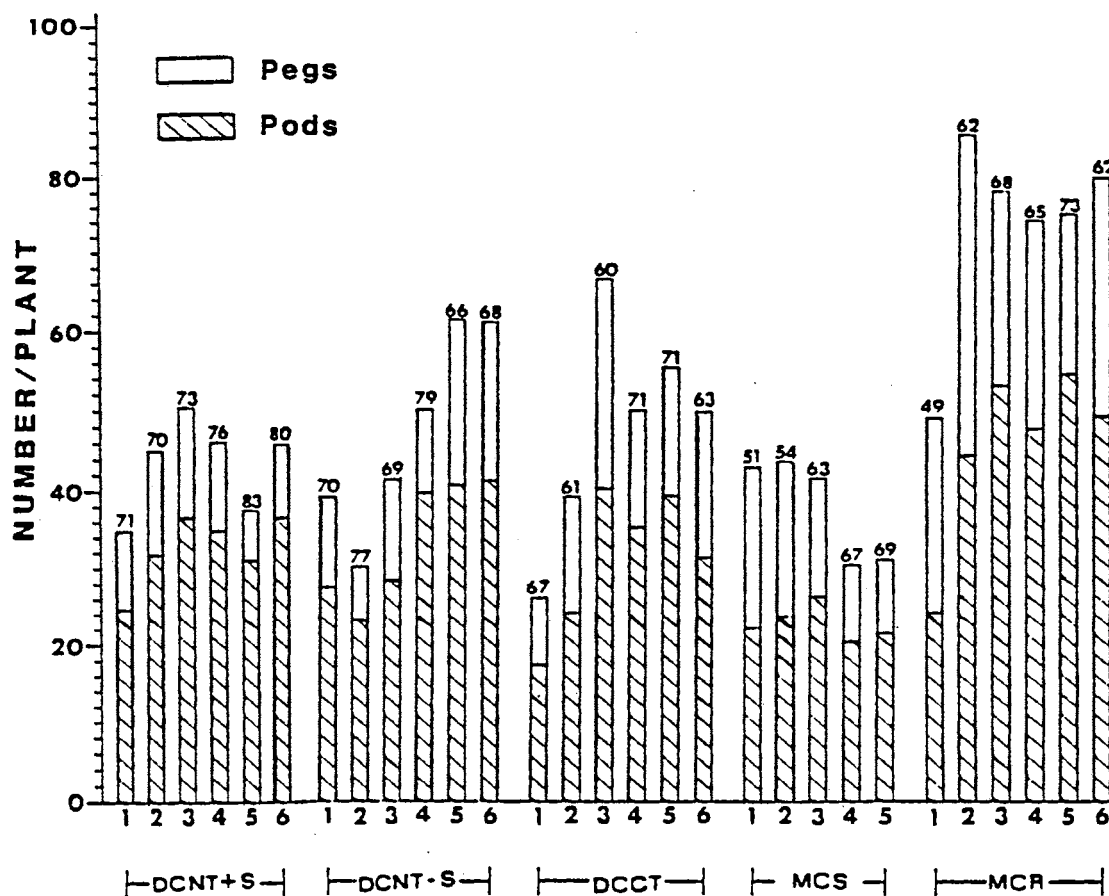


Figure 11. Relationship between peg and pod number per plant for each cropping system at each sampling date in 1984. (Number at top of bar represents the percentage of pegs with pods)

increase in percentage of pegs with pods. All other systems were variable over sampling dates. The double-cropped systems exhibited less variation than the monocropped systems. This seems to indicate that the majority of the crop was set within a short period of time. The lower percentages of pegs with pods in the monocropped systems on the first date may indicate that a new flush of pegs had recently been set before sampling. This could well be since peanuts are known to be indeterminate in their fruiting habit (Ketring, 1979), however, the relationships found in the double-cropped systems seem to indicate that peanuts perform in a more determinate manner when the growing season is shortened.

Figure 13 illustrates the relationship between green weight per pod and dry weight per pod in 1984. All double-cropped treatments were at approximately 15% dry weight per pod on the first sampling date. The MCS system was approximately 10% higher on this same date because of the 35 day older plants. The MCR system was at 18% pod dry matter. All double-cropped systems increased their pod weight to 42-46% dry matter. The MCR system was also in this range. The lower percentage dry weight for MCS (38%) may have been caused by a new flush of young immature pods set after the main flush of flowers. It is interesting to note that after only three weeks of sampling the double-cropped systems had achieved a pod dry matter of approximately 25% which was comparable to the MCS on the first sampling date.

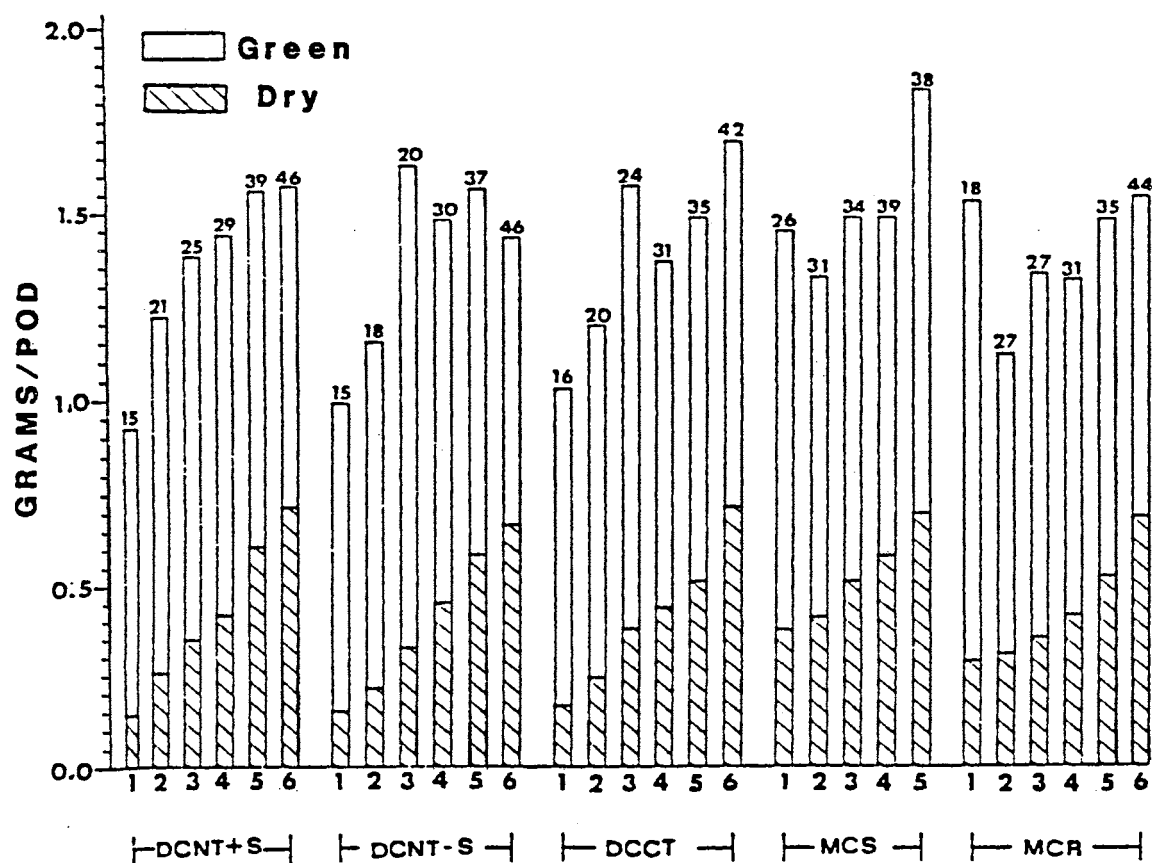


Figure 13. Relationship between green and oven dry weight per pod for each cropping system at each sampling date in 1984. (Number at top of bar represents percent dry weight)

The relationship between green weight per pod and dry weight per pod in 1985 is shown in Figure 14. The double-cropped spanish systems were approximately 13-19% lower in pod dry weight when compared with the monocropped spanish system on the first sampling date, however, by the second sampling date they were at levels comparable to the monocropped system. The results from the double-cropped systems are not in agreement with the theory that growing the peanuts in a double-cropping situation makes them perform in a more determinate manner. If they would have been in agreement with the peg and pod results, we would have seen a steady increase in percentage dry weight per pod over time, however the green weight per pod results could have been affected by soil moisture or sampling error.

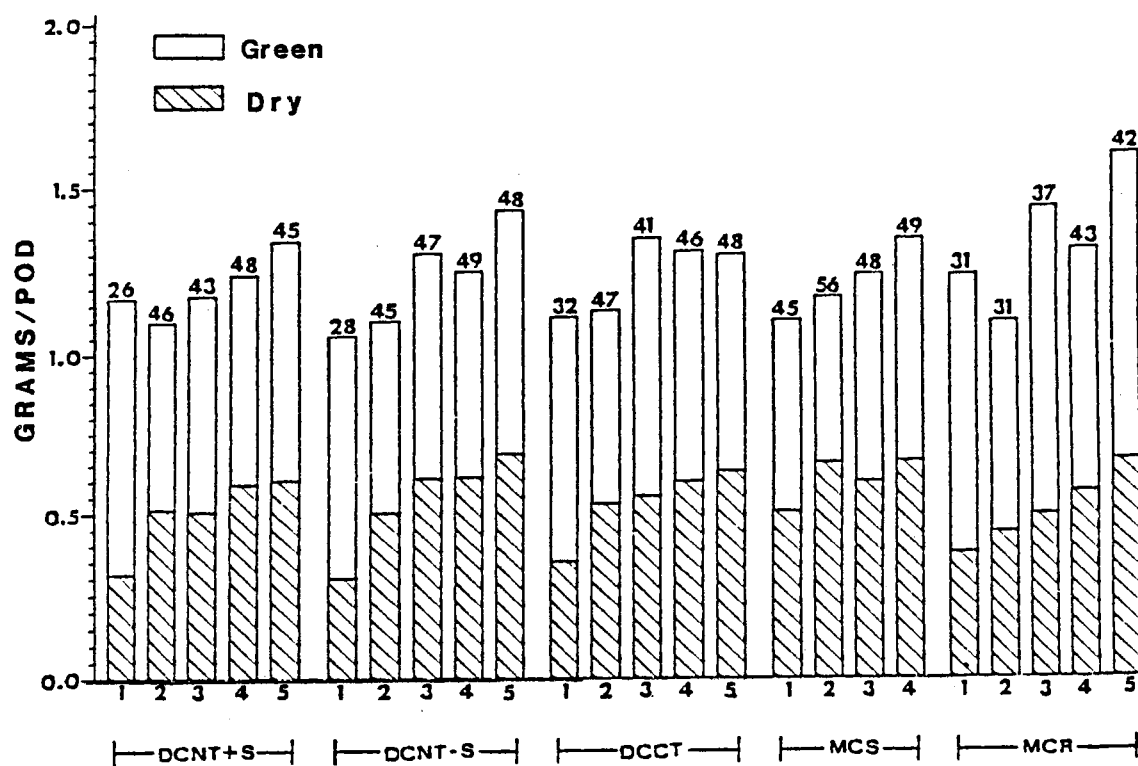


Figure 14. Relationship between green and oven dry weight per pod for each cropping system at each sampling date in 1985. (Number at top of bar represents percent dry weight)

## CHAPTER V

### SUMMARY AND CONCLUSIONS

Two separate field experiments were conducted, one in 1984 and one in 1985, to compare the agronomic and economic potential of six different cropping systems involving peanuts and/or wheat.

The results indicated that the MCR system with a green weight yield of 4108 kg/ha was significantly better than all double-cropped systems in 1984, however it was not significantly better than the MCS system which yielded 3805 kg/ha. The MCR system with a dry weight yield of 3646 kg/ha was also significantly better than all other systems in 1985. There were no significant yield differences among the remaining systems in the study.

The MCR system had the highest percentage of sound mature kernels in both years of the study. It was significantly better than all systems in 1984, but was significantly better than only the MCS system in 1985.

The MCS system had the highest percentage of sound splits for both 1984 and 1985. It was significantly higher than all other systems in 1984 but was not significantly higher than the double-cropped systems in 1985.

The two monocropped systems were significantly higher in percent total sound mature kernels than the double-cropped systems in 1984, however MCS and MCR were not significantly different. There were no significant differences among the double-cropped systems in 1984. There were no significant differences among any of the systems in 1985.

The MCS system had a significantly lower percentage of other kernels than the other systems in 1984 which were not significantly different from each other. There were no significant differences in percent other kernels among any of the systems in 1985.

Due to the high variation among observations of percent damaged kernels and the very low numbers observed, there were no statistically significant differences among the systems for either year.

The MCR system had the highest percentage of total kernels for both years. It was significantly higher than the other systems in 1984 but only significantly higher than the DCNT+S and the MCS systems in 1985.

The MCR system had the highest gross dollar return of peanuts per hectare in 1985 and was significantly better than the other systems which were not significantly different. MCR with a cover crop grazing return had the highest net dollar value per hectare but it was not significantly higher than MCR without a grazing return. There were no significant differences among the spanish systems, however all of the

peanut systems were significantly higher than the monocropped wheat system.

The three double-cropped systems were significantly lower in percent weed infestation than the MCS system but they were not significantly different from the MCR system in 1984. During the 1985 season the three conventionally planted systems were significantly lower in percent weed infestation when compared with the two no-till systems. DCNT+S was significantly lower than DCNT-S in percent weed infestation in 1985.

The MCR system had the highest percentage of Southern blight in 1985 but was significantly higher only when compared with the double-cropped systems. There were no significant differences among the double-cropped systems.

There were no significant differences noted in the numbers of root-knot nematode larvae in 1985 due to the high variation among observations.

Overall the no-till double-cropped and the conventionally planted double-cropped systems showed yield and dollar value potential when compared with the conventionally planted monocropped systems in the study, however, they were not competitive with the MCR system due to its inherent yield and grade advantage.

This preliminary investigation was designed to determine the agronomic and economic potential of short season double-cropped peanuts using various planting techniques and comparing them with standard production practices presently

used in Oklahoma. More research is needed to determine the various soil moisture and plant growth relationships of peanuts when grown under different no-till and/or double-cropped situations. Long term soil fertility and peanut pest studies also need to be conducted. The benefits of using no-till peanut planting techniques in reducing wind and water erosion also need to be documented.

The growth analysis relationships were studied to determine if there were any cropping system effects on various morphological characteristics important to peanut yields. Peg and pod numbers were highly variable throughout both studies.

The MCR system had more pegs per plant throughout 1984 when compared with the other peanut systems. The DCNT+S system was the only system to show a steady increase in peg numbers per plant in 1984. The MCS system exhibited peg losses throughout the sampling period. All other systems were curvilinear in their responses to time and exhibited peg losses 91 DAP for DCNT-S and DCCT and 125 DAP for MCR. These losses continued until the final sample date. The DCNT-S and DCCT systems lost pegs throughout the sampling period in 1985. The MCS system peaked 117 DAP. The DCNT+S system peaked 95 DAP and then dropped off dramatically.

The MCR system had more pods per plant throughout the sampling period in 1984. The double-cropped systems were very similar in pod numbers per plant in 1984. The MCS

system exhibited a gradual decrease in pod numbers during the sampling period.

Pod numbers per plant were highly variable in 1985. There were no significant differences among the systems in their rates of pod initiation or loss. The DCCT system had dramatic pod losses throughout the season and DCNT+S exhibited an extremely high rate of pod loss from 95 DAP until harvest.

There were significant differences in dry matter accumulation per pod per day in 1984. All systems exhibited a linear increase in pod dry matter per day. The DCNT+S system was the highest with a rate of 11.8 milligrams per pod per day and the MCR system had the lowest rate which was 8.3 milligrams per pod per day.

There were no statistically significant differences among the systems in dry matter accumulation per pod per day in 1985 although all systems showed a linear increase over time.

Potential peanut yields per hectare were calculated based on observed pods/plant X observed weight per pod X observed plants per hectare. The potential peanut yields increased linearly in 1984 and the slopes of the lines were significantly different. The MCR system exhibited the highest potential yield increase per day. It increased in potential peanut yields by 95.1 kg/ha/day during the sampling period.

There were significant differences in potential peanut yield increases per day in 1985, however, the responses were curvilinear in nature. MCR and DCCT increased more linearly than the other systems, while DCNT+S and DCNT-S were decreasing in potential yields per hectare approximately 102 DAP until sampling ended 123 DAP.

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VITA

Gregory Alan Turpin

Candidate for the degree of  
Master of Science

Thesis: DOUBLE-CROPPING PEANUTS AND WHEAT UTILIZING  
CONVENTIONAL AND NO-TILL PEANUT PLANTING  
TECHNIQUES

Major Field: Agronomy

Biographical:

Personal Data: Born in Ada, Oklahoma, October 17, 1961,  
the son of Ralph and Jimmie Nell Turpin; married  
Ines Virginia Pons on May 14, 1983; father of  
one daughter, Nicole Cristina Turpin.

Education: Graduated from Allen High School, Allen,  
Oklahoma, in 1979; received Bachelor of Science  
degree in Agronomy from Oklahoma State University,  
Stillwater, Oklahoma, in December 1983; completed  
requirements for the Master of Science degree in  
Agronomy at Oklahoma State University, in December,  
1986.

Professional Experience: Student Assistant, Department  
of Agronomy, Oklahoma State University, January  
1981 to December 1983; Graduate Teaching Assistant,  
Department of Agronomy, Oklahoma State University,  
January 1984 to May 1985; Agricultural Technician,  
Department of Agronomy, Oklahoma State University,  
June 1985 to present.

Member: American Peanut Research and Education Society;  
American Society of Agronomy; Crop Science Society  
of America.