A STUDY OF PEANUT CULTIVARS, ROW SPACINGS, PLANT DENSITIES, AND INTERACTIONS

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CHAPTER I

INTRODUCTION

Peanut (*Arachis hypogaea* L.) is a crop plant in the leguminous family. Its origin is not definitely known, but it is generally believed to be a native of South America. Peanut crops were cultivated in South American countries prior to the year 1555, and were recognized in the United States as early as 1781 (Killinger et al., 1947). Probably because of high adaptability to varying conditions and multitude of uses, peanuts are widely grown in many countries and regions of the world. Purposefully, peanuts have been cultivated for forage, food, feed, and oil. Peanuts have been used as a valuable protein source for humans for centuries. With their potential as a source of protein, peanuts have been viewed as an important supplementary source for protein, especially in the third world countries. Economically, peanuts are important to growers as well as to countries of production. In the United States, peanuts are an essential crop, and a major cash crop for growers of producing states.

In crop production, including the peanut, production can be raised by increasing the area of production, yield/unit area, or both. Practically, an increase in yield/unit area is more efficient and interesting than an increase in the area of production because arable land is becoming progressively more limited. Therefore, peanut production can be raised to acceptable levels by using modern agricultural technologies such as planting improved cultivars, employing appropriate cultural and management practices, using sound pest control schemes, and utilizing proper harvesting and curing methods. Several cultural practices may facilitate increases in peanut yields. One of many possibilities is growing peanuts at optimal plant population with suitable plant arrangement.

Peanuts cultivated in Oklahoma may be divided into two market types; spanish and runner. The spanish peanuts exhibit an erect or upright growth pattern with sparse to moderate vegetative branches, and with the pods being concentrated close to the base of the main stem. The runner peanuts, on the other hand, have a prostrate growth habit with moderate to profuse vegetative branches, and with the pods scattered along the lateral branches. Since peanut types vary in their growth habit, it is unlikely that any one combination of row spacing and plant density within the row would be optimal for all types. The differences in plant morphology and growth habit of these two peanut types may require different immediate environments for optimal growth and yield.

In Oklahoma, profitable peanut production requires all of the summer season. Most plantings are made with a row spacing of 91.5 cm (36 in) while the plant population within rows may vary widely depending on the desires of the growers. Planting a cultivar at its optimal rate may lead to a reduction in seed cost, improve early ground coverage, and increase yield due to better use of water, increased leaf surface and extended period for photosynthesis, and efficient utilization of mineral nutrients.

Planting peanuts at certain plant populations, theoretically, can result in maximum yield of that population density if plants are uniformly arranged in the growing area. Research on individual factors affecting peanut yield and grade factors have been conducted and reported with varying conclusions. However, the simultaneous study of cultivars, row spacings, within-row plant densities, and their interactions has been limited, particularly for Oklahoma conditions.

The objectives of the research reported were to investigate the influence of row spacing, plant density, and population density on yield and quality of peanuts, to determine the optimum plant population(s) with appropriate spatial arrangement(s), and simultaneously to compare the yielding potential of four recommended peanut cultivars grown under irrigation in Oklahoma.

CHAPTER II

REVIEW OF LITERATURE

Research on peanut plant populations and spatial arrangements have been reported by many investigators. The results have varied with types of peanuts and environmental factors of the conducted experiments. Most results, however, indicated yield responses to changing plant populations.

The yield response of peanuts to plant density was reported as early as 1899 in Arkansas (Bennett, 1899). Spanish peanuts grown in 24-inch rows produced a higher yield than those in 36-inch rows, and 4-inch spacing between plants in the rows was better than 6-, 8-, 12-, and 18-inch spacings. Later, Funchess and Tisdale (1924) reported that the average peanut yield over five years of spanish peanuts grown in Alabama at 18x4 inches was approximately 120% higher than the usual farm spacing of 36x12 inch (1785 lbs/a vs. 813 lbs/a). Peanut yield declined from 59.5 to 39.0 bu/a when space/plant increased from 72 to 192 in^2, and from 47.9 to 27.1 bu/a when space/plant increased from 216 to 432 in^2. He mentioned that spanish peanuts must be planted thick for large yields.

Beattie et al. (1927) reported that Improved Spanish peanuts grown under rainfed conditions in South Carolina in 30-inch rows at a 3-inch drill spacing produced a higher yield than those spaced at 6-, 9-, 12-, and 15-inch drill spacings. The peanuts in 30 x 3 inch spacing yielded higher than peanuts grown in 36-inch rows at the various drill spacings. Pod yield as well as hay yield was higher for close spacings.

McClelland (1931), in Arkansas, grew spanish and valencia peanuts under rainfed conditions over a 10 year period in 12-, 18-, 24-, 30-, and 36-inch rows with 2 to 16 inches between plants in the rows. Considerable gain in pod and hay yield were obtained with the narrower row spacing and closer hill placement. For spanish, 6-, 8-, and 9-inch spacings in 36-inch rows yielded similar to 10- and 12-inch spacings in 30-inch rows. Also, 8-inch spacing in 24-inch rows and 2- and 4-inch spacings in 30-inch rows produced the same peanut yields. This was true for valencia except that 6-, 8-, and 9-inch spacings in 30-inch rows yielded less than 10-and 12-inch spacings in the same row width. However, he concluded that 30-inch rows with 4- to 6-inch plant spacings were generally accepted for both peanut types since good production and ease of management were both assured.

In 1934, at the Georgia Coastal Plain Experiment Station, it was reported that the highest yields of spanish peanut were obtained from 18-inch rows with plants spaced 6 inches apart. For ease of cultivation, however, 24- and

30-inch spacings were favored (Anonymous, 1934).

West (1942) reported the results of spacing experiments under rainfed conditions in Mississippi in which White Spanish produced the highest average pod yield as well as hay yield with the narrowest spacing of 24 x 6 inches, and the lowest average yields with the widest spacing of a 36 x 8 inch pattern. In contrast, the highest peanut and hay yields of runner peanuts were obtained from 30 x 12 inch and 24 x 12 inch patterns, respectively. He also reported from another experiment that 18-inch rows increased yields of spanish peanuts over 24-, 30-, and 36-inch rows.

McClelland (1944) conducted experiments for valencia and spanish peanuts employing 30- and 36-inch rows and 8, 12, and 16 inches between hills in the rows. Over a nine year average, the highest pod yield was obtained from 30 x 8 inch spacing for valencia while the spanish cultivar yielded slightly higher at 36 x 8 inches. However, there was little difference in peanut yield between 30- and 36-inch rows. For both cultivars, the highest hay production was obtained from a 30 x 8 inch spacing.

Killinger et al. (1947) grew runner peanuts in 30-inch rows at 6-, 12-, and 24-inch drill spacings and spanish peanuts in 30-inch rows at 3-, 6-, and 9-inch drill spacings. The average yield increases for runner peanuts were 370 and 46 lbs/a for 6-inch and 12-inch drills, respectively, over the 24-inch spacing. Similarly, 3-inch and 6-inch drills of spanish yielded 359 and 145 pounds, respectively, over the 9-inch drill. They recommended that runner peanuts in Florida be grown in 30- to 36-inch rows with 6- to 8-inch drill spacings and that spanish peanuts be planted in 24-inch rows with 3- to 5-inch drill spacings.

Bailey (1951), under Georgia conditions, recommended that row spacings of 28 to 34 inches and 30 to 36 inches, each with at least three sound seeds/linear foot of row were sufficient for good yields for bunch and runner peanuts, respectively.

Oram (1958) stated that planting peanuts at high plant populations was being used in Africa as an insurance against losses from rosette disease. The recommended rate under rainfed conditions varied from 40,000 to 145,000 plants/a depending on cultivar, moisture regime, and the likelihood of the disease. The highest yields were generally obtained from high populations, and yield increased as high as 40% as spacing decreased. The close spacing produced seeds with more uniform maturity.

In Virginia, Shear and Miller (1960) conducted rainfed spacing experiments on jumbo runner peanuts planted at various equidistant spacings from 6 x 6 to 16 x 16 inches. The highest yield was obtained from the 6 x 6 inch spacing which was more than double the average yield for this cultivar with the standard spacing of 30 x 12 inches. Yield/plant decreased as the spacing between plants decreased. The closer spacing retarded the rate of fruit development and border effects were more pronounced.

Lipscomb (1961) reported that, under high fertilization and unirrigated conditions, changing row spacing from 36 to 12 inches did not affect yields of Virginia Bunch 67 peanuts, but significantly increased yields of Dixie Spanish and Early Runner cultivars were obtained when row spacing was changed from 36 to 24 inches.

Matlock (1961), working in Oklahoma on Argentine and Spantex peanuts under both irrigated and nonirrigated conditions, reported that the average peanut yields increased with a decrease in row spacing from 40 to 20 inches. The average yields were 2,126, 1,858, and 1,776 lbs/a for 20-, 30-, and 40-inch row spacings, respectively. However, peanut grades were lower from the narrower row spacing. A seeding rate of 4.8 seeds/ft produced a yield of 50 lbs/a more than a rate of 2.4 seeds/ft and 183 lbs/a more than a rate of 9.6 seeds/ft.

Lutrick et al. (1961), in Florida, planted spanish, Virginia Bunch 67, and Dixie Runner peanuts at equidistant spacings of 6, 8, 10, and 12 inches, and at the conventional spacing of 36 x 3 inches. The first three spacings produced higher yields than the conventional spacing for the spanish cultivar while all spacings were superior to the conventional spacing for Virginia Bunch 67. For Dixie Runner, however, the 12-inch equidistant spacing yielded more than the conventional treatment. In a similar study, Lutrick et al. (1962) reported that only the yield of the 8-inch spacing was higher than the check (36 x 3 inches) in

Spanette, but all spacings yielded better than the check for both Virginia Bunch 67 and Dixie Runner.

Phillips and Norman (1962) conducted rainfed experiments using 24- and 36-inch rows, and the four plant populations of 10,000, 20,000, 40,000, and 80,000 plants/a. Kernel yields of Virginia Bunch were not significantly influenced by varying populations, but the highest kernel and hay yields were obtained at the 80,000 plants/a rate. For Natal Common, however, the maximum kernel and hay yields were produced at 40,000 plants/a. The average kernel yield was appreciably higher with 24-inch than 36-inch rows. The optimum economic seeding rates were approximately 30 lbs/a (10,000 plants) for Virginia Bunch and 45 lbs/a (30,000 plants) for Natal Common.

Basinski et al. (1964) in Australia reported from a two-year experiment that yield of peanuts planted at the rate of 45 lbs/a was significantly higher (223 lbs/a) than that of 30 lbs/a, but there was no significant difference in yield when the planting rate was raised to 60 lbs/a.

Duke and Alexander (1964) conducted spacing experiments on Virginia Bunch 46-2 and Virginia 56R cultivars in 12-, 18-, and 36-inch rows. Virginia Bunch 46-2 produced significantly higher yields in closer rows in two out of three years with the highest yield obtained from the closest spacing. The closer spacings, however, caused a reduction of extra large kernels. Contrarily, for Virginia 56R, yields from close spacings were significantly lower than those from 36-inch rows in two out of three years, but fancy pods, extra large kernels, and sound mature kernels were not affected by the spacings. They noted that the lower yields of the close spacings were probably due to a dry season in one year of the study, and the 18-inch row spacing was recommended in Virginia.

Meredith (1964) reported on a study with bunch-type peanuts planted at 4,800 to 129,000 plants/a in 30- and 36-inch rows under various fertilizer levels. Planting 1 or 2 plants/hill did not significantly affect kernel yields. There were significant decreases in kernel yields as well as haulms with lower populations, but there were no significant yield increases when raising the plant population from 19,000 to 129,000 plants/a. Increased plant population by planting at 30- rather than 36-inch ridges resulted in a slight yield increase. The number of mature peanuts/plant increased with increased plant spacing.

Smartt (1964) reported on two studies with bunch-type peanuts under rainfed conditions. The first study involved all spacing combinations of 36-, 18-, and 12-inch rows with 3-, 6-, and 12-inch plant spacings, while the other experiment consisted of all combinations between 12- and 24-inch rows with 6- and 12-inch plant spacings. The highest yields were obtained from the 12 x 12 inch spacings. At any plant population, however, six out of seven comparisons showed that yields were superior when planted in narrower rows. Planting peanuts at populations above the optimum for yield resulted in lower market grade.

Cox and Reid (1965), in a series of experiments with NC-2 peanuts, showed that yield increased with increasing plant population. The greater response was observed with greater reduction in row width. The average yield increases over the 36-inch rows were 290, 490, and 690 lbs/a for 24-, 18-, and 12-inch rows, respectively. Yields increased as plant spacing in the row decreased. The observed yields were 2,440, 2,190, 1,970, and 1,850 lbs/a for 6-, 12-, 18-, and 24-inch plant spacings, respectively. The grade differences associated with reduction in row width were generally small, and were either increased or remained the same as plant spacing decreased. They noted that, if the level of production was 3,600 lbs/a or more, reducing row spacing had little effect on improving yield.

In Florida under rainfed conditions, Lipscomb et al. (1965) grew Early Runner and Dixie Spanish peanuts in 12-, 18-, 24-, and 36-inch rows with plants 4 inches apart in the rows. They found significant yield increases with closer row spacings in two out of three years studied for Dixie Spanish, and also yield increases although not significantly for Early Runner. The 12-inch rows produced fewer peanuts/plant but hay yields were higher in close row spacings.

Goldin and Har-Tzook (1966) grew Virginia Bunch Improved peanuts under irrigated conditions in 65 cm rows and 15, 20, 25, 30, and 40 cm plant spacings with 1 seed/hill for the three smallest spacings and 2 seeds/hill for the others. They found that increased plant spacing resulted in marked increases in pod yield/hill and slight increases in the percentage of mature pods; however, pod yield/unit area was not increased.

Banerjee et al. (1967), in India, carried out rainfed spacing experiments by planting B-30 (bunch-type) and a selection from AK-10 peanuts in 12-, 18-, and 24-inch rows with 3, 6, and 9 inches between plants within the rows. The highest yields were produced with 24 x 6 and 18 x 6 inch spacings for sandy loam soil and laterite soil, respectively. They concluded that the 24 x 6, 24 x 9, 18 x 3, 18 x 6, and 12 x 9 inch spacings were appropriate for sandy loam soil conditions, and 18 x 6 and 24 x 6 inch spacings for laterite soil.

Tahir and Misovic (1967) planted Barberton (early maturing, upright-bunch) and Ashford (medium-late maturing, spreading-bunch) peanuts under irrigated conditions in 60 cm rows with 30, 15, and 7.5 cm intra-row spacings and 1 or 2 seeds/hill resulting in plant populations from 17,000 to 88,000 plants/a. Yield/plant was higher at lower plant populations. The spreading-bunch cultivar produced more yield/plant at lower plant populations while the upright-bunch cultivar was superior at higher plant populations. The arrangement of plants within rows at similar populations had little effect on yield, field germination of kernels before harvest, and oil content. The optimum population was

55,000-60,000 plants/a.

Norden and Lipscomb (1968) reported that four peanut genotypes grown in 45.7 cm rows produced 12% higher yields than when grown in 91.4 cm conventional rows. The yield increase was larger with the erect (bunch) growth habit than with the prostrate (runner) growth habit.

In Oklahoma, Whitney et al. (1969) grew Argentine (spanish-type) peanuts on 40 inch wide flat beds. The treatments were (1) two rows 34 inches apart, (2) three rows 17 inches apart, (3) four rows 11.3 inches apart, (4) five rows 8.5 inches apart, (5) six rows 6.8 inches apart, (6) seven rows 5.7 inches apart, and (7) eight rows 4.9 inches apart. There was a trend for yield increase in close row spacing for both dryland and irrigated conditions. Row spacing had no significant effect on the percentage of sound mature kernels or sound splits for irrigated peanuts, but close row spacing lowered the kernel grade of dryland peanuts.

Mixon (1969) conducted spacing studies in Alabama during 1962-1963. Early Runner, Virginia Bunch 67, and Virginia Runner G26 were planted in 12-, 18-, and 36-inch rows with drill spacings of 3, 4.5, and 6 inches in the row, giving plant populations from 29,000 to 116,000 plants/a in the row. There were no statistical differences for yield, grade factors, or the various interactions. The highest average yields were obtained from the 36-inch rows and the 3-inch drill spacing. However, he reported an approximately

14% yield increase in 3-inch over 6-inch spacing in 18-inch rows.

Kirby et al. (1970) reported on experimental results with Dixie Spanish peanuts grown under rainfed conditions on 80-inch beds at five various spacings: (1) two rows 40 inches apart, (2) three rows 30 inches apart, (3) four rows 20 inches apart, (4) seven rows 10 inches apart, and (5) two sets of two rows 10 inches apart with 20 inches between the sets. The populations were calculated to be 22,992, 49,389, 55,656, 95,785, and 57,552 plants/a, respectively. In one year, yields and grade factors were not significantly different but yields from treatments 1 and 4 were lower than the other treatments. The highest yield, 1,919 lbs/a, was obtained from treatment 5, the two-pair pattern. The percentage of mature fruit, fruits/plant, and kernels/plant declined when row spacing was narrowed. In another year, however, yields of treatments 1 and 2 were significantly higher than the other treatments. The two spacings involving four rows (treatments 3 and 5) had similar yields while the seven-row 10-inch treatment produced the lowest yield. There was a trend of yield reduction when row spacing was narrowed. The percentage of sound mature kernels was significantly lower from the seven-row 10-inch treatment, while the percentage of other kernels from this treatment was higher than from the other treatments. They suggested that moisture was probably the critical factor and insufficient to maintain the large plant populations in narrow row spacings, because only minimum rainfall was received during the growing season.

Morris (1970) reported on growing spanish peanuts in Oklahoma under irrigation on 40-inch flat beds using three row spacings with a seeding rate of 10 to 12 seeds/foot of row for all spacings. The spacings were (1) 'wide' for two rows 34 inches apart, (2) 'paired' for two pairs of rows 5 inches apart with 25 inches between the pairs, and (3) 'narrow' for three pairs of rows 5 inches apart with 10 inches between the pairs. There was a linear trend for yield increase from wide to narrow spacing. Plant height and percentage of other kernels increased, but pod numbers/plant, pegs/plant, percentage of sound splits, and sound mature kernels decreased as row spacing was narrowed. The gross returns/a increased when changing from wide to narrow spacing.

Harrison (1970) reported results from an experiment conducted in Texas from 1963 to 1969 on seeding rates and multiple rows on 40-inch beds. Yields of spanish peanuts grown under irrigation increased when seeding rates increased from 60 to 130 lbs/a, and the highest yields were usually received from seeding rates of 120 to 130 lbs/a. The twin rows 5 to 10 inches apart nearly always yielded more than single row planted peanuts at any seeding rate. Planting three rows on a bed frequently yielded more than those with twin rows/bed.

Alexander (1970) reported from Virginia that Va.67-189, a peanut with sparse vegetative growth habit and fruit concentrated around the taproot, produced the highest yield when planted with close spacing at 46 x 8 cm. The Va.61R and Florigiant, on the other hand, were less affected by varying spacing patterns.

In Sudan, Ishag (1970) conducted a spacing study on Ashford (semi-spreading, alternatively branched type) and Barberton (upright, sequentially branched type) peanuts under irrigated conditions. The row spacings were 40, 60, and 80 cm with 2 seeds/drill at spacings of 15 and 30 cm, respectively. The 60 x 15 cm spacing produced the highest yield for Ashford while the 40 x 15 cm spacing was best for Barberton. The 15 cm plant spacing yielded approximately 13% more than the 30 cm plant spacing. The percentage of fruit set increased with increased row spacing while number of seeds/pod increased with decreased plant spacing. He noted that the optimum spacing for these cultivars varied because of differences in their growth habits.

Wood (1970) studied the effects of single rows and twin rows of various seeding rates on establishment and yield of Spantex peanuts grown under rainfed conditions. The treatments used were: (1) single rows at 50 lbs/a, (2) twin rows at 50 lbs/a, (3) twin rows at 75 lbs/a, and (4) twin rows at 100 lbs/a. From four years of results, the twin rows spaced 6 inches apart with 36 inches between the centers of the pairs of rows and the conventional 36-inch rows produced yields not significantly different from each other. However, in one season with good amount and distribution of rainfall, a significant yield increase was observed when seeding rates changed from 50 to 100 lbs/a. The establishment was improved by up to 12% with twin rows. The seeding rate of 50 lbs (40,000 plants/a) was optimum for Spantex at Katherine, Northern Territories, Australia.

In India under rainfed conditions, Bhan and Misra (1970) reported, with AK 12-24 (erect, early maturing) and PG1 (spreading, late maturing) peanuts, that the highest pod yields were produced at 45x25 cm. Also, Walters and Yoon (1970) reported from Malaysia that fresh weight, dry weight, and seed weight were significantly higher from the narrowest spacing of the three patterns of 12 x 9, 12 x 6, and 12 x 4 inches studied.

King (1971), in Georgia, grew Starr and Early Runner cultivars under irrigated conditions in four spacings: (1) the conventional two pairs of rows/bed with 40.6 cm (16 in) apart and 25.4 cm (10 in) between rows of each pair, (2) 17.8 x 17.8 cm (7 x 7 in) seven rows/bed, and (3) 25.4 x 25.4 cm (10 x 10 in) five rows/bed. The bed was 127 cm (50 in) with spacing between beds of 35.6 cm (14 in). The plant populations for those three patterns were 321,230, 321,230, and 153,202, plants/ha, respectively. Yield, plant height, and pod length were greater in the four-row and 17.8x17.8 cm spacings than in the 25.4 x 25.4 cm spacing. The reverse results were observed on a per plant basis for leaf area, leaf weight, peg number, pod number, and pod weight.

Spacing had no effect on weight/firm pod.

Saini et al. (1971), under rainfed conditions, showed with spreading-type M-145 peanuts that none of the square spacings of 22.5 x 22.5, 30 x 30, 37.5 x 37.5, and 45 x 45 cm produced higher yields than the standard 30 x 15 cm spacing. The pod yields of these spacings were significantly different and decreased progressively with an increase in the area/plant. Increased seeding rate from 1 to 3 seeds/hill resulted in a significant increase in pod yield with marked differences in wider spacings. The number and weight of mature pods increased with an increase in spacing but decreased with an increase in the number of seeds/hill. Decrease in space between plants resulted in higher yield/ha although the yield/plant decreased. The wider spacings slightly decreased the shelling percentage. An increase in the number of seeds/hill tended to give a slightly better shelling percentage and oil content. The recommended spacings were 30 x 15 cm or 22.5 x 22.5 cm each with 1 seed/hill.

Bhan and Misra (1972), reported with AK12-24 and PG1 grown under rainfed conditions at 30, 45, and 60 cm row spacings that pod weight/plant, shelling percentage, 100 kernel weight, oil content, number of functional leaves, and dry plant weight increased with wider spacings. Pod weight/plant and shelling percentage were significantly correlated with dry weight of plant at flower initiation period.

Chin Choy (1972) concluded from a six year study under both irrigated and nonirrigated conditions that spanish peanuts planted in narrow rows (10- or 12-inch) consistently produced higher yields than 36- or 40-inch rows, and 2 to 4 plants/foot was the ideal plant spacing within the rows.

Norden and Lipscomb (1974) reported with bunch-type (erect) and runner-type peanuts grown at equal plant populations under rainfed conditions that yield increased when planted in 46 cm rather than in 91 cm row spacing. Yield increases were 16% and 5% for bunch-type and runner-type, respectively. Increased yields from close rows were highest in the more favorable seasons and in the genotype with the smallest plants. Row spacing had little effect on seed weight, shelling percentage, and shriveled seed percentage.

Laurence (1974), under rainfed conditions, reported with four commercial Malawian peanut cultivars that pod number/plant had inverse relationship to plant density. Kernel yield and shelling percentage were low at reduced plant populations, and yields and kernel size declined at very high populations. Peanuts with different growth habits required different plant populations to produce maximum yields. At certain plant populations, however, arrangements in row spacings were critical to achieve the highest yields. The optimum population for the jumbo runner type was 5 plants/m^2 in either 61 or 91 cm rows, 8 to 9 plants/m^2 in 61 cm rows for spreading bunch type, and 14 to 16 plants/m^2 for erect bunch type in 61 cm rows. A 12.5% yield increase in 61 cm rows over 91 cm rows was observed.

In North Carolina, Wynne et al. (1974) studied the effects of four inter-row and two intra-row spacings with growth regulator on size and yield of NC17 and NC5 peanut cultivars. The inter-row spacings were (1) two rows 91.4 cm apart, (2) three rows 61 cm apart, (3) twin rows - a pair of rows 30.5 cm apart on a bed with 91.4 cm between bed centers, and (4) five row beds - five rows, 30.5 cm apart on a bed with 182.9 cm between the center of each bed. The intra-row spacings were 12.7 and 25.4 cm. Inter-row spacing less than 91.4 cm did not significantly increase the yield and fruit size, and had no effect on fancy size pods, extra large kernels, sound mature kernels, and fruit length. Reduction in yield was observed when intra-row spacing was greater. Increasing the intra-row spacing reduced extra large and sound mature kernels in NC17 significantly, but increasing the intra-row spacing increased fancy size pods yet reduced seed size and yield in the NC5 cultivar. They noted that seeding rate should not be more than 100 kg/ha.

Muhammad and Dorairaj (1974) reported from India that bunch peanut cv. TMV2 grown at 14 different spacings ranging from 15 x 15 to 45 x 37.5 cm under irrigation produced the highest average yield of unshelled peanuts at 15 x 15 cm spacing.

Jagannathan et al. (1974) concluded from a three season experiment that TMV7 peanuts grown under irrigation produced the highest dry pod yields with 22.5 x 10 cm spacing, a plant density of 440,000 plants/ha, and was closely followed by 10 x 10 cm and 10 x 15 cm spacings.

Cahaner and Ashri (1974) grew four virginia-type peanuts under irrigated conditions at standard density (7,575 plants/1,000 m^2), medium density (150% standard), and high density (200% standard). The spacings were two rows 57 cm apart, three rows 35 cm apart, and four rows 26 cm apart for standard, medium, and high densities, respectively. The plant spacing was 20 cm for all densities. The four peanut cultivars, differing in growth habit and plant size, produced similar yields in all densities. Vegetative growth and also reproductive organs (pegs and pods) per unit area increased as stand density increased at all maturity stages, but mature pods as well as pod weight were equal in the three densities. They noted that yield did not increase with increasing plant densities because crowding did not lead to earlier termination of pod setting.

In Oklahoma, McCauley (1975) grew Comet peanuts under irrigation in 30 and 90 cm rows, both in North-South and East-West row orientations, and found that the highest yields were produced with the narrow rows.

Malagamba (1976), in Florida, conducted a study to evaluate the response of Florunner (prostrate), and UF-70115 (semi-erect) grown at various approximately equidistant spacings. The selected populations ranged from 3.6 to 26.3 plants/m^2, and 5 to 50 plants/m^2 for two consecutive years, respectively. The general pattern of yield response to increasing plant density was independent of growth habit and was characterized by three well-defined phases: (1) fast increase in yield up to a density level of 7.5 plants/m^2, (2) yield plateau phase, and (3) slow yield decline starting at a population level of approximately 20 to 22.5 plants/m^2. The number of pods was the main yield component associated with yield response to varying plant densities. He postulated that the inadequate number of mature pods/unit area at plant densities lower than optimum, and a reduced amount of photosynthates diverted to developing fruits at densities higher than optimum, were the factors causing the lower yields in those plant population ranges.

Gilman and Smith (1977) grew ten peanut genotypes differing in botanical type and geographical source in Texas at conventional (5 to 8 cm) and wide (46 cm) intra-row plant spacings in 102 cm row spacings under irrigation. Higher maximum percentages of mature fruits (MPMF) were obtained at the close rather than at the wide intra-row spacing.

Chin Choy et al. (1977) found that peanuts grown under irrigation in Oklahoma in 30 cm rows produced higher yields than 90 cm rows, although yield/plant was lower in 30 cm rows. Peanut quality was not affected by changing row spacings.

Azu and Tanner (1978) grew spanish peanuts in square patterns with five plant densities. Vegetative and reproductive growth were reduced on a per plant basis but increased on a per unit area basis with increased plant density. The highest yields were consistently obtained from the medium and high densities, 11.34 and 25.51 plants/m^2, respectively, and yield response to density was more pronounced when the production level was low. The shelling percentage and sound mature kernels were not affected by changing plant density, except, in one test at a plant density of 102.04 plants/m^2, an excessive formation of immature pods and seeds was obtained.

A rainfed spacing experiment was conducted and reported by Kushwaha and Mishra (1978). They used three row spacings of 30, 37, and 45 cm, in combination with plant spacings of 8, 15, and 23 cm, and found that 37 cm rows consistently produced the highest yields in the three years studied. The closer plant spacings produced higher peanut yields, and the 37 x 8 cm spacing was consistently superior to the other spacings. Increased plant spacing resulted in higher numbers of mature and also immature pods/plant, but lowered the 100 pod weight, 100 kernel weight, and shelling percentage.

In Oklahoma, Abdul Al-Jabbar (1978) found that Comet peanuts grown in 25 and 100 cm rows under irrigation produced the highest yields with the narrow rows.

Hauser et al. (1979) conducted experiments in Alabama and Georgia from 1977-1978. They compared Florunner peanuts planted at a standard seeding rate in 80 cm rows to (1) a 10% reduction in 80 cm rows, (2) a 25% reduction in 40 cm rows, and (3) a 50% reduction in 20 cm rows. Peanuts planted in 20 and 40 cm rows yielded approximately 15% more than the standard 80 cm rows. The downward adjustments in seeding rate reduced the yield increase due to row spacing by 1 to 3%.

Yayock (1979), in Nigeria, conducted rainfed experiments at three locations during 1974-1976 with five peanut cultivars grown in 60 cm rows and with varying plant numbers within the rows. Pod yield, shelling percentage, and haulm yield increased with increasing plant density. The average pod yields were 3,170 and 4,869 kg/ha for the two extreme populations of 43,000 and 271,000 plants/ha, respectively, however, the recommended planting rate for Nigeria conditions is 100,000 to 157,000 plants/ha.

Gopalaswamy et al. (1979) grew erect bunch peanuts under irrigated conditions using six spacing combinations of 40, 30, and 22.5 cm between rows and 15 and 10 cm between plants. The 30 x 10 cm spacing was significantly superior in both years studied. There was a reduction in yield when spacing was increased beyond 30 x 10 cm and also with the closest spacing of 22.5 x 10 cm. The maximum number of pods/plant was obtained from the widest spacing (40 x 15 cm) and the least from the closest spacing (22.5 x 10 cm). A similar response was observed for 100 kernel weight, but the shelling percentage was not affected by varying spacings.

In Florida and Georgia, Florunner peanuts were grown in 20.3, 40.6, and 81.2 cm rows with the same seeding rate within rows of all spacings. Peanut yields and hay yields generally increased with decreasing row width while peanut quality was not adversely affected. The percentage of sound mature kernels was sometimes increased as the row width narrowed. Increases in peanut yields ranged from 7% to 40% when spacing was narrowed from 81.2 to 40.6 and 20.3 cm, respectively (Buchanan and Hauser, 1980).

Mozingo and Coffelt (1980), in Virginia, conducted an experiment during 1977-1979 to evaluate the effect of single-row and double-row patterns at two plant populations using Florigiant (runner growth habit) and Va.71-347 (bunch growth habit). Row patterns significantly affected percentage of fancy pods which was higher in the single-row pattern. Yield, crop value, and sound mature kernels at the plant population of 215,274 plants/ha were significantly higher than at 143,516 plants/ha. The highest yield was received from Va.71-347 planted at high plant population in either the single- or double-row pattern.

In Canada, Starr peanuts were grown under irrigation in 41, 61, twin-row 61-31, 81, and 102 cm rows, and at the plant populations of 180,000, 330,000, 460,000, and 570,000 plants/ha. Yield, total kernels, and sound mature kernels increased as seed spacing was narrowed, and the highest values were produced from 41 cm rows. Plant populations of 180,000 and 330,000 plants/ha produced higher pod yields than higher populations (Roy et al., 1980).

In Virginia, Mozingo (1981) compared skip-row and solid plantings using Florigiant and NC7. He grew either single row or twin rows (18 cm apart) centered for each 91 cm row. The skip-row pattern was two rows planted and one skipped. Skip-row plantings produced significantly higher yield and value/ha than solid plantings, and the twin rows, skip-row plantings gave the highest yield and value with both cultivars. Skip-row planting increased yield 2.8% for the single-row pattern but increased 12.1% in the twin-row pattern. However, there was a significant interaction of row pattern (single or twin) with planting pattern (solid or skip-row).

Knauft et al. (1981) reported the seven-year results on six peanut genotypes grown under irrigation in Florida. Three plant spacings (10.2, 15.2, and 30.5 cm) in 91 cm rows produced nonsignificantly different yields in Dixie Runner, UF714021, and UF439-16-6-3. Florunner and Florigiant produced the same yields at 10.2 and 15.2 cm, and both were significantly higher than at 30.5 cm. Early Bunch, at 15.2 cm spacing, produced significantly higher yield than at 30.5 cm, but did not significantly differ from 10.2 cm. Grade factors were generally not affected by plant spacings. The six peanut genotypes could be planted with little or no yield reduction at spacings near 15 cm.

Chin Choy et al. (1982) conducted a series of experiments employing spanish peanuts grown under irrigated and nonirrigated conditions. The row spacings and the within-row plant densities were: (1) row spacings of 1, 0.75, and 0.5 m with 8, 15, and 32 viable seeds/m of row, (2) row spacings of 1, 0.75, 0.5, and 0.25 m with 7, 15, and 22 viable seeds/m of row, (3) row spacings of 0.3 and 0.9 m with 19 plants/m of row, and (4) row spacings of 0.15, 0.3, 0.45, and 0.9 m with 19 plants/m of row. By interpolation of the observed data, they concluded that the 0.25 m row spacing produced the highest peanut yield for both irrigated and nonirrigated conditions, and approximately 15 plants/m was the optimum plant spacing for both yield and quality in all row spacings.

Schubert et al. (1982) reported the results from a four-year experiment of skip-row and solid planting patterns with Florunner and Tamnut 74. The planting patterns were solid, two rows planted with one row fallow (2 & 1), and two rows planted with two rows fallow (2 & 2). There were no differences in yield, grade factors, and crop value among those patterns under irrigated conditions. Under rainfed conditions, however, the skip-row patterns produced significantly higher yield, grade, and crop values than the solid pattern.

In China, Pan (1982) reported that wide-narrow row systems produced higher yields than conventional planting. Rows alternately 39.6 and 19.8 inches apart with 19.8 inches between double sown hills, and rows alternately 39.6 and 19.8 inches apart with 16.5 inches between double sown hills, produced 7.7% and 7.9% higher than conventional row x plant spacings of 19.8 x 24.5, and 23.1 x 20.6 inches, respectively. The optimum spacing was 33 to 39.6 inches for the wide and 19.8 inches for the narrow row with 19.8 inches between hills.

Davidson et al. (1983) reported that nonirrigated Florunner peanuts at close row spacing (twin rows 6 to 10 inches apart on 36 inch centers) produced slightly higher yields than wide row spacing (36 in). The close row spacing provided slightly higher average emergence percentages, cooler soil temperature, and larger crop around the taproot. The close row spacing was effective in conserving soil moisture and provided benefits to the peanut crop during drought stress periods.

Kvien et al. (1983) noted that 21 peanut genotypes exhibited a very accurate method for adjusting pod number to the space occupied by each plant. As plant population decreased from 1 plant/500 cm^2 to 1 plant/5,000 cm^2, yield decreased only 35%. They concluded that a tremendous number of row spacing-seeding rate combinations could be made at a certain plant population.

Saini et al. (1971) found that changing plant populations or spacings not only affected yield but also plant characters. Peanut plants tended to be dwarf with an increase in spacing and tended to be tall with an increase in the number of seeds/hill. Knauft et al. (1981) found that main stem height for six peanut genotypes decreased significantly as plant spacing increased from 10.5 to 30.5 cm but concluded that the spacings had no effect on plant growth habit, vegetative plant disease incidence, and pod disease incidence. Cahaner and Ashri (1974) found that peanuts grown at high density accumulated significantly more shoot dry matter than normal density from one month after planting until the end of the season, and also provided significantly higher ground cover throughout the season. Malagamba (1976) found that increasing peanut plant populations resulted in a continuous increase in weight of vegetative plant components, particularly branches and leaves while maximum weight and number of reproductive units was attained at densities around 30 plants/m^2. Further increases in plant density caused a stabilization in number of fruiting units,a small reduction in total weight of the reproductive fraction, a slight increase in the average weight of reproductive units, and an increase in weight of seeds larger than 10 mm in diameter. Complete ground cover in the higher yielding densities occurred at an average time of 50 days after planting. Plant density had a marked effect on the branching system, which is directly related to fruit development and yield pattern. At densities above optimum, yield decline resulted from earlier and more severe competition.

Peanut plant populations and spacings also have effects on soil water and water use by plants. Saint-Smith (1969) mentioned that planting at high populations produced better yields when water supply was adequate but lower yields if the water supply was low. Chin Choy (1972) found that narrow row peanuts (10 or 12 inches) consistently yielded more than the 36- or 40-inch rows. The orientation of the rows perpendicular to the wind direction and close row spacings reduced the amount of water lost by the evapotranspiration process, and the decrease of the amount of water lost by evapotranspiration in the system had no detrimental effect on the quality or quantity of peanuts. McCauley (1975) found that the soil water content below 30 cm rows was higher than below 90 cm rows resulting from the lower net radiation in 30 cm rows which, in turn, conserved the water more effectively during the periods of high evaporative demand. Chin Choy et al. (1977) found water loss through evapotranspiration in 30 cm rows was less than for 90 cm rows. Water use efficiency was increased by increased yield effect and a water conservation effect. Abdul Al-Jabbar (1978) reported that peanuts in 25 cm rows produced higher yields and had higher leaf diffusive resistance than in 100 cm rows.

In Alabama, Mixon (1969) noted that close-row arrangements were beneficial in terms of weed and disease control and required less cultivation. Hauser et al. (1979) reported that weed weights were lower in 20 cm rows than for 40 cm rows, but the differences were not significantly reflected in peanut yields. Buchanan and Hauser (1980) found that weed growth with close rows (20.3 and 40.6 cm) of peanuts was much lower than with the standard (81.2 cm) rows, resulting in higher hay and peanut production for close rows. Yields of peanuts and hay were drastically lower with increased time of weed competition. Yield could be increased as much as 50% by elimination of weed competition.

Tahir and Misovic (1967), working with peanut plant populations between 17,000 and 88,000 plants/a, found that planting at low plant populations resulted in higher field germination of kernels before harvest.

Whitney et al. (1969) reported that decreases in row spacing tended to increase digging and shaking losses due to more plant interference at harvest but reduced combine loss.

CHAPTER III

MATERIALS AND METHODS

The study was conducted at the Caddo Peanut Research Station, Ft. Cobb, Oklahoma, during the summer seasons of 1981 and 1982. The experimental sites were situated on Cobb fine sandy loam soil, a member of the Fine-Loamy, Mixed, Thermic Udic Haplustafs.

In each year, four peanut cultivars, 'Florunner' (Norden et al., 1969), 'Pronto' (Banks and Kirby, 1983), 'Spanco' (Banks and Kirby, 1981), and 'Tamnut 74' (Simpson and Smith, 1975), were planted with a Swanson (manufactured by Swanson Machine Co., 24-26 East Columbia Ave., Champaign, Illinois, 61820) single row, hand-propelled cone planter, on 183 cm wide (72 in) flat beds. Four row spacing patterns were employed in the study as if the plots were being planted with a tractor and a basic 2-row planter; i.e. no rows were planted behind the tire tracks of the tractor. The first row spacing, designated 'wide', had two rows 91.5 cm (36 in) apart and would be the equivalent of solid, or uniform 91.5 cm rows. The second row spacing, 'intermediate', had three rows 45.7 cm (18 in) apart between the tractor tracks resulting in an actual row spacing pattern of 91.5 - 45.7 - 45.7 - 91.5 - 45.7 - 45.7 - 91.5, etc. The third row spacing, 'narrow', had four rows 30.5 cm (12 in) apart between the tractor tracks resulting in an actual row spacing pattern of 91.5 - 30.5 - 30.5 - 30.5 - 91.5 - 30.5 - 30.5 - 30.5 - 91.5, etc. The fourth row spacing, 'twin', had four rows with 20.3 cm (8 in) between each of the twins and 71.1 cm (28 in) between the inner rows of the twins and would give a solid or uniform pattern of 20.3 - 71.1 - 20.3 - 71.1 - 20.3, etc. between all rows (Figure 1). Three within-row plant densities of 2, 4, or 6 plants/30.5 cm (12 in) of row were used within all row spacing patterns and for all cultivars. Thus, the four cultivars, the four row spacing patterns, and the three plant densities were factorially arranged and resulted in 48 treatment combinations.

The experimental design was a split-plot randomized block, with cultivars as the main plot factors and the row spacing and plant density as the sub-plot factors. The 48 factor combinations were replicated four times in each year.

The overall plot size planted for each factor combination was 5.48 x 4.26 m (18 x 14 ft). The ends of the plots were trimmed at an early growth stage to give 3.65 m (12 ft) for uniform length of rows. The center 1.82 x 3.65 m (6 x 12 ft) of each plot was harvested for statistical analysis at the end of the growing season. The additional 1.82 x 3.65 m on each side of the harvested plots served as borders.

In 1981, two replications were planted on May 22 and

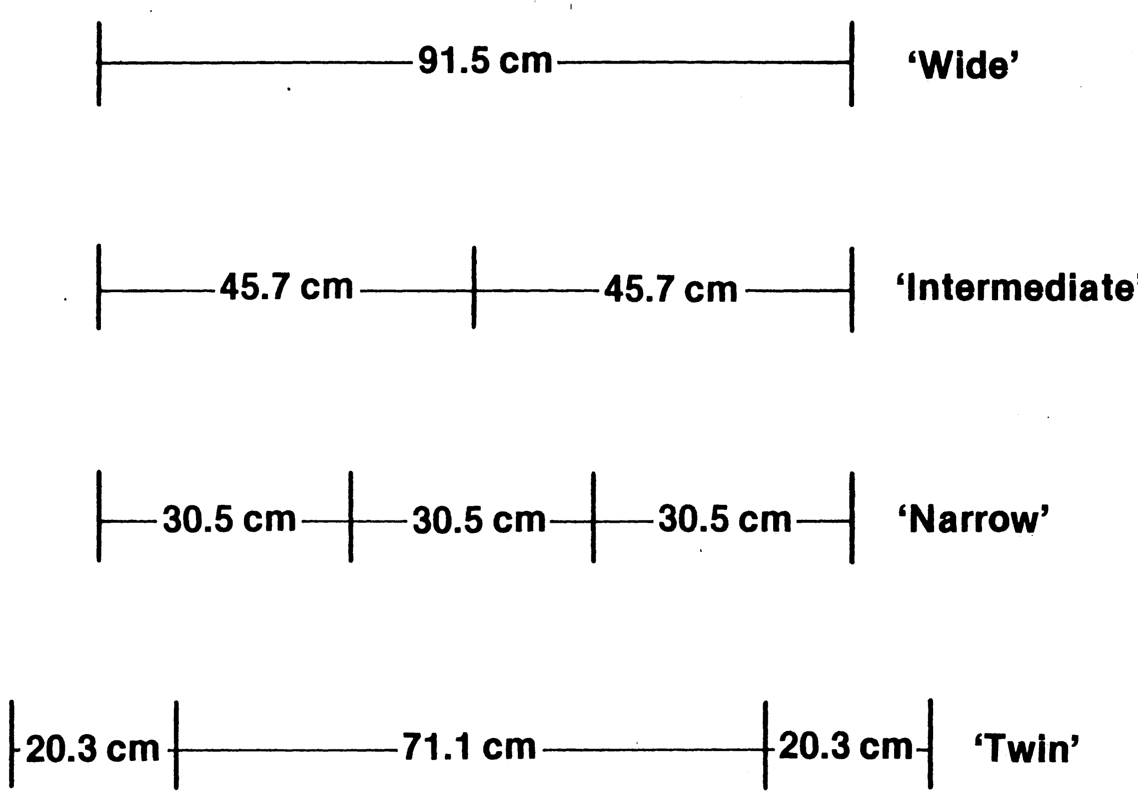

Figure 1. Row Spacing Patterns in 183 cm Wide Bed

the other two replications on May 26. Planting in 1982 was performed on June 8 and 9, each with two replications. Seeds of all cultivars were treated with commercially available rhizobium inoculant prior to planting. The cultural practices of 1981 and 1982 were similar. In both seasons, seedbed preparation was made by plowing and springtoothing early in the season. In 1981, fertilizer at the rate of 112 kg/ha of 12-0-39 as indicated by soil analysis, was applied to the experimental field during land preparation. Disking and springtoothing were performed immediately before planting. Balan and Dual herbicides were used in 1981, while Balan, Vernam, and Lasso were applied in 1982. Later in the season, weeds were controlled by chemical spot-spraying, rolling cultivator, and hand hoeing. Nematocides used were Soilbrom and Terr-o-cide for 1981 and 1982, respectively. The insecticide, Comite, was the only one used in both seasons. In 1981, Bravo fungicide was used for control of early leafspot caused by Cercospora arachidicola Hori.

Overhead sprinkler irrigation was used to apply 36.75 cm (15 in) and 72.88 cm (29.75 in) of water for 1981 and 1982, respectively. Rainfall recorded during the growing season was 45.31 cm (17.84 in) in 1981 and 18.28 cm (7.20 in) in 1982.

At the end of the growing seasons, the plots were dug with a two-row inverter digger (Digger-Shaker-Windrower Lilliston 2700 Model) equipped with extended or overlapping cutting blades. The plots were dug on November 19 in 1981, and on October 19 and 26 in 1982. After digging, the peanuts were field cured for 4 to 5 days, then threshed with a small-plot peanut thresher (manufactured by Marushin Seisaksho Co., LTD H385 Yachimata-machi Chiba-ken, Japan). The harvested peanuts from each plot were bagged and tagged separately. The bagged peanuts were then heat dried until pod moisture reached approximately 10%. The peanuts were allowed to equilibrate for several days then cleaned and weighed for yield.

For each plot, a 200 g pod sample was randomly taken for grade determination. Grade analysis procedures followed those used by the Federal-State Inspection Service at peanut buying points, and included percentages of other kernels (OK), damaged kernels (DMK), sound splits (SS), sound mature kernels (SMK), and total sound mature kernels (TSMK). Weights of 100 seed from the sound mature kernel category were also determined. All of the grade determinations were made at the Oklahoma State University Peanut Breeding Research Laboratory.

Analyses of variance for the characters studied were made at the Oklahoma State University Computer Center. The analyses of variance for yield and grade factors in this study were performed as a split-plot design having cultivars as main plot factors, and the row spacing and within-row plant density as sub-plot factors. The comparisons of all characters were made by trend analysis procedures. The statistical breakdown for sources of variation is presented in Table 1.

Because of different growth habits, comparisons for all characters studied were made between Florunner and the three spanish cultivars, Pronto, Spanco, and Tamnut 74; between cultivars of the same growth habit but differing in genetic background, i.e., Tamnut 74 vs. Pronto and Spanco; and between cultivars of the same genetic background, Pronto and Spanco.

For row spacing, comparisons were made among all patterns, and among 'narrow' and 'twin' row patterns since these patterns involved four rows per bed. The comparison among row patterns having single row arrangements, i.e., 'wide', 'intermediate', and 'narrow', was also performed in this study.

TABLE 1

STATISTICAL BREAKDOWN FOR SOURCES OF VARIATION

Source	df	
Rep	3	
Cultivar	3	
PST - F		1
PS - T		1
P - S		1
Rep x Cultivar (Error a)	9	
Row Spacing	3	
Row Linear		1
Row Quadratic		1
Narrow - Twin		1
Plant Density	2	
Plant Linear		1
Plant Quadratic		1
Cultivar x Row Spacing	9	
PST - F x Row Linear		1
PS - T x Row Linear		1
P - S x Row Linear		1
PST - F x Row Quadratic		1
PS - T x Row Quadratic		1
P - S x Row Quadratic		1
PST - F x Narrow-Twin		1
PS - T x Narrow-Twin		1
P - S x Narrow-Twin		1
Cultivar x Plant Density	6	
PST - F x Plant Linear		1
PS - T x Plant Linear		1
P - S x Plant Linear		1
PST - F x Plant Quadratic		1
PS - T x Plant Quadratic		1
P - S x Plant Quadratic		1
Row Spacing x Plant Density	6	
Row Linear x Plant Linear		1
Row Linear x Plant Quadratic		1
Row Quadratic x Plant Linear		1
Row Quadratic x Plant Quadratic		1
Narrow-Twin x Plant Linear		1
Narrow-Twin x Plant Quadratic		1
Cultivar x Row Spacing x Plant Density	18	
Error b	132	

CHAPTER IV

RESULTS AND DISCUSSION

In this study the terms 'wide', 'intermediate', 'narrow', and 'twin' designated for the row spacings; the terms 'low', 'medium', and 'high' designated for the within-row plant densities; and the abbreviations for grade factor categories previously mentioned in Chapter III will be used throughout the discussion. There were large differences with respect to yield and grade factors in the two years. The data were analyzed by years because large interactions of cultivar and year were obtained for all characters when the combined analyses were attempted.

In both years the results (Tables 2 and 3) showed statistical differences between cultivars with respect to yield and grade factors at an observed significance level (OSL) of 1% except that DMK in 1982 was statistically different only at an OSL of 10%. Row spacing as well as plant density significantly affected yield in the two years studied. However, some of the grade factors were significantly different for row spacing and/or plant density only in 1982. The row spacing x plant density interaction was statistically significant for yield in both years, and OK and 100 seed weight in 1981 and 1982, respectively.

TABLE 2

ANALYSES OF VARIANCE FOR CHARACTERS STUDIED, 1981

Source	df	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels
		kg/ha	g	%				
Rep	3							
Cultivar	3	**	**	**	**	**	**	**
"Error a"	9	67192	11.06	2.68	2.46	28.22	37.86	16.48
Row Spacing	3	**						
Cultivar x Row Spacing	9				≠			
Plant Density	2	**						
Cultivar x Plant Density	6				≠		≠	*
Row Spacing x Plant Density	6	≠		*				
Cultivar x Row Spacing x Plant Density	18							
"Error b"	132	94731	5.61	1.95	2.04	16.04	26.09	17.01
Mean		2912	48.16	2.57	2.09	9.95	59.81	69.77
C.V. %		10.56	4.91	54.26	66.70	40.24	8.53	5.91

**, *, ≠ Indicate significance at the 0.01, 0.05, and 0.10 levels of probability, respectively.

TABLE 3

ANALYSES OF VARIANCE FOR CHARACTERS STUDIED, 1982

Source	df	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels
		kg/ha	g	--------	--------	%	--------	--------
Rep	3							
Cultivar	3	**	**	**	≠	**	**	**
"Error a"	9	230658	18.02	0.51	0.29	2.80	4.13	2.84
Row Spacing	3	*	*	≠			≠	≠
Cultivar x Row Spacing	9							
Plant Density	2	**	≠			**		*
Cultivar x Plant Density	6			*				≠
Row Spacing x Plant Density	6	**	≠					
Cultivar x Row Spacing x Plant Density	18			≠		≠		
"Error b"	132	148423	6.01	3.10	0.22	1.88	11.37	11.44
Mean		3639.62	48.20	3.15	0.23	4.03	64.44	68.52
C.V. %		10.58	5.08	55.83	201.39+	33.70	5.23	4.93

**, *, ≠ Indicate significance at the 0.01, 0.05, and 0.10 levels of probability, respectively.

+ Indicates an observed range of 0.00 to 1.55.

There was no interaction for cultivar x row spacing, cultivar x plant density, or cultivar x row spacing x plant density for yield in either year. The cultivar x row spacing interaction was significant only for DMK in 1981 and for none of the characters in 1982. The cultivar x plant density interaction was significant for DMK, SMK, and TSMK in 1981, and for OK and TSMK in 1982. The three factor interaction was nonsignificant for any character in 1981, but was significant for OK and SS at an OSL of 10% in 1982.

Pod Yield

In both years, significant yield differences were produced with peanut cultivars, row spacings, and plant densities (Tables 4 and 5). In 1981, Florunner produced the highest yield and thus also exceeded the average of the three spanish cultivars (Table 6). In contrast, in 1982, Spanco produced the highest yield and the yield averaged from the three spanish cultivars was higher than that of Florunner (Table 7). Among the spanish cultivars, Tamnut 74 exceeded the average yield of Pronto and Spanco in both years (Tables 8 and 9). However, this difference had an OSL of 24% in 1982. Pronto was superior to its relative, Spanco, in 1981, but the reverse was observed in 1982 (Tables 6 and 7).

In 1981, the yield production trend of Florunner tended to increase when plant density changed from 'low' to 'medium' but tended to decline when changed from 'medium' to

TABLE 4

ANALYSIS OF VARIANCE FOR YIELD, 1981

Source*	F Value	OSL
Cultivar	140.09	<0.01
PST-F	322.20	<0.01
PS-T	66.40	<0.01
P-S	31.69	<0.01
Row Spacing	8.34	<0.01
Row Linear	3.23	0.07
Row Quadratic	20.15	<0.01
Plant Density	7.83	<0.01
Plant Linear	1.32	0.25
Plant Quadratic	14.33	<0.01
PS-T x Row Quadratic	3.84	0.05
PST-F x Plant Quadratic	4.72	0.03
Row Spacing x Plant Density	1.91	0.08
Row Linear x Plant Linear	2.46	0.12
Row Linear x Plant Quadratic	3.70	0.06

*All sources of variation having an OSL of 29% or larger have been excluded from this table.

TABLE 5

ANALYSIS OF VARIANCE FOR YIELD, 1982

Source*	F Value	OSL
Cultivar	15.72	<0.01
PST-F	33.77	<0.01
PS-T	2.48	0.24
P-S	10.90	0.03
Row Spacing	3.09	0.03
Row Linear	3.49	0.06
Row Quadratic	2.61	0.11
Plant Density	10.48	<0.01
Plant Linear	16.84	<0.01
Plant Quadratic	4.11	0.04
P-S x Row Linear	2.32	0.13
Narrow-Twin x Plant Linear	9.88	<0.01
Row Spacing x Plant Density	4.16	<0.01
Row Linear x Plant Linear	1.80	0.18

*All sources of variation having an OSL of 28% or larger have been excluded from this table.

TABLE 6

MEAN YIELDS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1981

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	kg/ha				
Florunner	3467	3659	3343	3507	3494
Pronto	2835	2897	2603	2637	2743
Spanco	2400	2541	2422	2417	2445
Tamnut 74	2914	3269	2795	2891	2967
Mean	2904	3092	2791	2863	2912
Florunner	3467	3659	3343	3507	3494
Pronto+Spanco+ Tamnut 74	2716	2902	2607	2648	2718
Pronto+Spanco	2618	2719	2513	2527	2594
Tamnut 74	2914	3269	2795	2891	2967

TABLE 7

MEAN YIELDS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1982

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	kg/ha				
Florunner	3298	3326	3315	3501	3360
Pronto	3269	3716	3699	3586	3567
Spanco	3704	3851	3795	3958	3827
Tamnut 74	3732	3845	3783	3857	3804
Mean	3501	3684	3648	3725	3640
Florunner	3298	3326	3315	3501	3360
Pronto+Spanco+ Tamnut 74	3568	3804	3759	3800	3733
Pronto+Spanco	3487	3784	3747	3772	3697
Tamnut 74	3732	3845	3783	3857	3804

TABLE 8

MEAN YIELDS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1981

Cultivar	Plant Density			Mean
	Low	Medium	High	
	kg/ha			
Florunner	3435	3731	3316	3494
Pronto	2787	2778	2664	2743
Spanco	2342	2575	2418	2445
Tamnut 74	2973	3041	2888	2967
Mean	2884	3031	2822	2912
Florunner	3435	3731	3316	3494
Pronto+Spanco+Tamnut 74	2701	2798	2657	2718
Pronto+Spanco	2564	2677	2541	2594
Tamnut 74	2973	3041	2888	2967

TABLE 9

MEAN YIELDS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1982

Cultivar	Plant Density			Mean
	Low	Medium	High	
	kg/ha			
Florunner	3134	3481	3464	3360
Pronto	3380	3621	3701	3567
Spanco	3714	3926	3841	3827
Tamnut 74	3612	3850	3951	3804
Mean	3460	3719	3740	3640
Florunner	3134	3481	3464	3360
Pronto+Spanco+Tamnut 74	3569	3799	3831	3733
Pronto+Spanco	3547	3773	3771	3697
Tamnut 74	3612	3850	3951	3804

'high' plant density (Table 8 and Figure 2d). A similar yield production trend was also observed in the spanish cultivar average, however, the quadratic response to plant density was not the same for the two peanut types as indicated by the PST - F x Plant Quadratic interaction at an OSL of 3% (Table 4 and Figure 2d). Tables 4 and 6 and Figure 2c also indicate that the quadratic response to row spacing was not the same for Tamnut 74 and the average of Pronto and Spanco in 1981 as indicated by the PS - T x Row Quadratic interaction at an OSL of 5%.

In 1982, the interaction (OSL 13%) of yield production trends of similar genetic background peanuts, Pronto and Spanco, with row linear (Table 5) indicated changes were of different magnitude when decreasing row spacing from 'wide' to 'narrow'. Yield increased when row spacing decreased from 'wide' to 'narrow' in both Pronto and Spanco but the difference was more pronounced at the 'wide' row spacing (Table 7).

For row spacing, the highest yields were obtained from 'intermediate' rows in 1981 but from 'twin' rows in 1982 (Tables 10 and 11). Yields increased when rows were narrowed from 'wide' to 'intermediate', but declined when row spacings were decreased to the 'narrow' pattern. Figure 2a illustrates the linear and quadratic response obtained in 1981. Linear and quadratic responses were also obtained in 1982 except that the linear trend was in the reverse direction with higher yields from 'narrow' rows. No

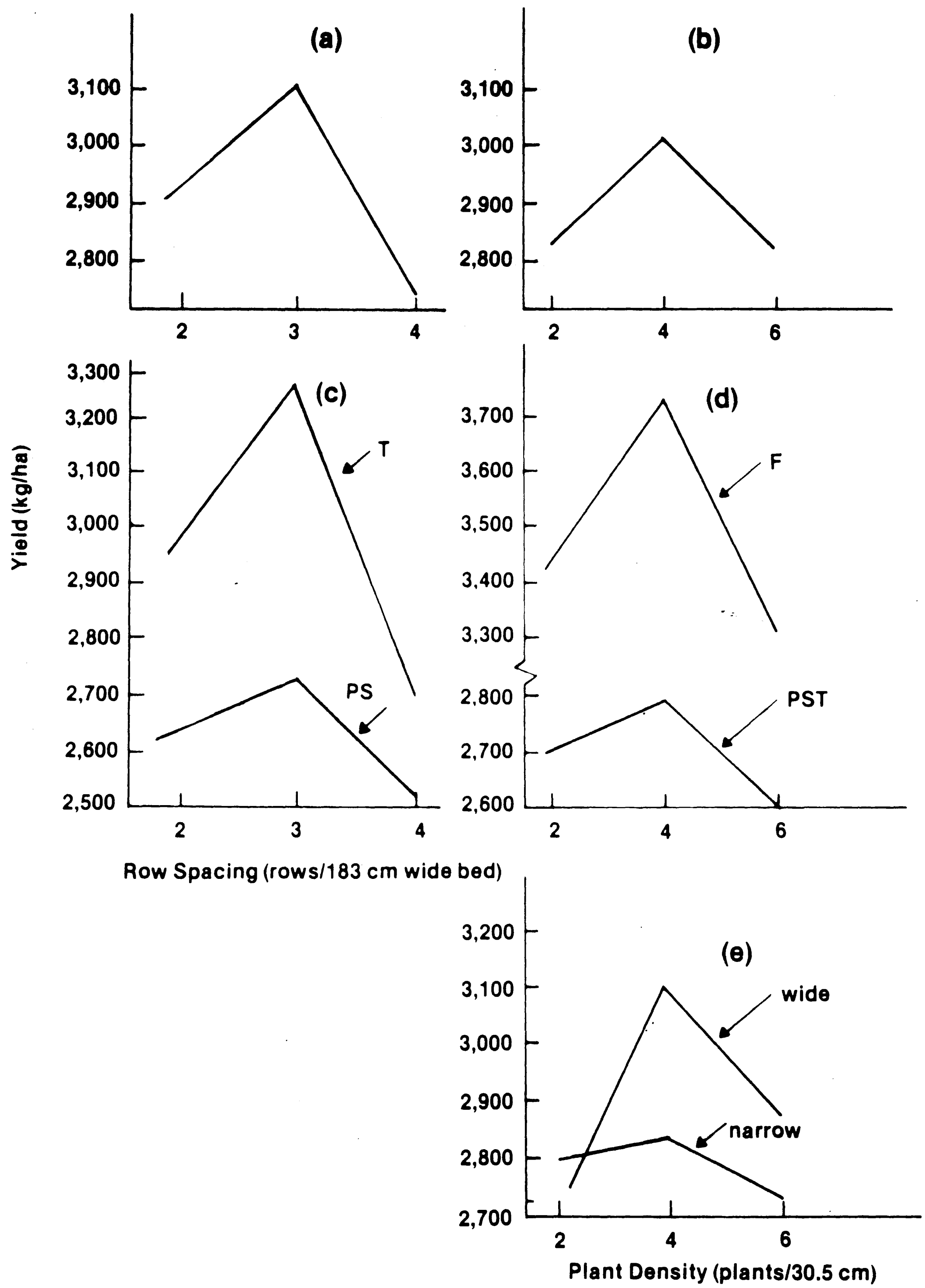

Figure 2. Graphic Representation of Linear and Quadratic Responses Obtained from Analysis of Variance for Yield, 1981

significant yield difference between 'narrow' and 'twin' rows was observed in either year (Tables 4 and 5).

TABLE 10

MEAN YIELDS AT VARIOUS SPATIAL ARRANGEMENTS, 1981

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	kg/ha			
Wide	2710	3121	2880	2904
Intermediate	3087	3236	2952	3092
Narrow	2804	2837	2732	2791
Twin	2935	2931	2723	2863
Mean	2884	3031	2822	2912

TABLE 11

MEAN YIELDS AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	kg/ha			
Wide	3142	3600	3761	3501
Intermediate	3401	3867	3786	3684
Narrow	3456	3672	3816	3648
Twin	3841	3740	3596	3725
Mean	3460	3719	3740	3640

Differences in yield production were observed from various plant densities (Tables 4 and 5). The highest yields were obtained from 'medium' and 'high' plant densities in 1981 and 1982, respectively (Tables 10 and 11). Yield tended to decrease from 'low' to 'high' plant density in 1981 (OSL 25%) but increased in 1982. In both years, however, there was a quadratic response to plant density with highest yield resulting from 'medium' plant density. This response for 1981 is illustrated in Figure 2b.

The yield production trends of 'wide' and 'narrow' rows over various plant densities were not statistically similar. In 1981, yield of 'wide' rows increased from 'low' to 'high' plant density while yield decreased in 'narrow' rows (Tables 4 and 10, Figure 2e). However, yield of both 'wide' and 'narrow' rows peaked at 'medium' plant density. The most pronounced difference of production trends thus was observed at the 'medium' plant density. In 1982, yield of 'wide' and 'narrow' rows tended to increase when plant density changed from 'low' to 'high' (Tables 5 and 11). The largest difference of the trends was found at the 'low' plant density. The comparison of yield production trends of 'narrow' and 'twin' rows over plant denstiy levels was significantly different at an OSL of <1% (Table 5). Yield tended to increase in 'narrow' but tended to decline in 'twin' rows with increased plant density (Table 11). The results indicated dissimilar responses of the same peanut plant populations to different spatial arrangements.

Although the highest average yields were not consistently produced with certain row spacing and certain plant density, as indicated by interaction of row spacing and plant density (Tables 4 and 5), the highest yields were obtained from the 'medium' plant density in 'intermediate' rows in both years (Tables 10 and 11).

In this study, the yield difference between Florunner and the spanish cultivars was inconsistent in the two years. This could be due to the differences in maturity of these cultivars and the variation of the growing seasons. In 1981, Florunner was favored over the spanish cultivars because of its late maturity and the longer season. The spanish cultivars (particularly Pronto and Spanco) suffered some loss from being left in the ground too long. Thus, mean yield, 100 seed weight, and TSMK of the spanish cultivars averaged lower than Florunner in 1981 (Table 12). In 1982, the spanish cultivars were superior to Florunner in yield and TSMK (Table 13). This may be due to the earlier maturity of the spanish cultivars and the considerably shorter growing season of 1982. This is evident in the lower TSMK of Florunner and the higher TSMK averaged from the spanish cultivars in 1982 compared with 1981. The higher yielding potential of Tamnut 74 over the average of Pronto and Spanco may be explained by their genetic differences since consistent results were observed (Tables 6 and 7). It should also be noted that the maturity of Tamnut 74 is considered to be later than Pronto and Spanco but

TABLE 12

MEAN VALUES FOR YIELD, 100 SEED WEIGHT, AND TOTAL SOUND MATURE KERNELS, 1981

Cultivar	Yield	100 Seed Weight	Total Sound Mature Kernels
	kg/ha	g	%
Florunner	3494	60.52	73.71
Pronto	2743	46.81	70.95
Spanco	2445	41.95	64.28
Tamnut 74	2967	43.37	70.10
Mean	2912	48.16	69.76

TABLE 13

MEAN VALUES FOR YIELD, 100 SEED WEIGHT, AND TOTAL SOUND MATURE KERNELS, 1982

Cultivar	Yield	100 Seed Weight	Total Sound Mature Kernels
	kg/ha	g	%
Florunner	3360	54.99	62.75
Pronto	3567	47.63	72.76
Spanco	3827	47.86	69.25
Tamnut 74	3804	42.33	69.31
Mean	3640	48.20	68.51

earlier than Florunner. The inconsistent performance of Pronto and Spanco (cultivars with similar genetic background) can possibly be explained by the differences in optimal growing periods in the two years studied.

100 Seed Weight

Peanut cultivars produced statistically different 100 seed weights in both years while row spacing and plant density affected 100 seed weight only in 1982 (Tables 14 and 15). Florunner produced the largest seeds as expected and thus were larger than the average of the spanish cultivars in both years. The average 100 seed weight of Pronto and Spanco was slightly larger than Tamnut 74 in 1981 (OSL 12%) but was considerably larger in 1982 (Tables 14, 15, 16, and 17). Pronto produced statistically higher 100 seed weight than Spanco in 1981. Spanco may have been more sensitive than Pronto to loss of mature pods in the longer growing season of 1981. A statistical difference between Florunner and the spanish cultivars was also observed in 'narrow' and 'twin' rows in 1981 (Table 14). The 100 seed weight tended to decrease in Florunner but increase in the spanish cultivars when row spacing changed from 'narrow' to 'twin' (Table 16). Pronto and Spanco vs. Tamnut 74 in 1982 was also influenced by row patterns (Tables 15 and 17). Although similar declining trends were observed when row spacing changed from 'wide' to 'narrow', Tamnut 74 had a larger 100 seed weight in the 'intermediate' rows resulting

TABLE 14

ANALYSIS OF VARIANCE FOR 100 SEED WEIGHT, 1981

Source*	F Value	OSL
Cultivar	615.71	<0.01
PST-F	1740.19	<0.01
PS-T	5.86	0.12
P-S	101.07	<0.01
PST-F x Narrow-Twin	4.38	0.04

*All sources of variation having an OSL of 15% or larger have been excluded from this table.

TABLE 15

ANALYSIS OF VARIANCE FOR 100 SEED WEIGHT, 1982

Source*	F Value	OSL
Cultivar	215.49	<0.01
PST-F	490.35	<0.01
PS-T	155.89	<0.01
Row Spacing	3.11	0.03
Row Linear	5.81	0.02
Plant Density	2.28	0.11
Plant Quadratic	4.46	0.04
PS-T x Row Quadratic	3.42	0.07
Row Spacing x Plant Density	2.02	0.07
Row Linear x Plant Linear	6.84	<0.01

*All sources of variation having an OSL of 19% or larger have been excluded from this table.

TABLE 16

MEAN 100 SEED WEIGHTS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1981

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	g				
Florunner	60.33	60.05	61.78	59.91	60.52
Pronto	47.44	46.72	46.90	46.19	46.81
Spanco	40.80	41.99	41.90	43.11	41.95
Tamnut 74	43.50	43.57	42.74	43.66	43.37
Mean	48.01	48.08	48.33	48.22	48.16
Florunner	60.33	60.05	61.78	59.91	60.52
Pronto+Spanco+ Tamnut 74	43.91	44.09	43.84	44.32	44.04
Pronto+Spanco	44.12	44.35	44.40	44.65	44.38
Tamnut 74	43.50	43.57	42.74	43.66	43.37

TABLE 17

MEAN 100 SEED WEIGHTS OF PEANUT CULTIVARS
AT VARIOUS ROW SPACINGS, 1982

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	g				
Florunner	55.44	55.76	54.60	54.16	54.99
Pronto	48.19	47.38	47.70	47.25	47.63
Spanco	48.87	47.97	46.81	47.79	47.86
Tamnut 74	42.64	43.66	41.20	41.84	42.33
Mean	48.78	48.69	47.58	47.76	48.20
Florunner	55.44	55.76	54.60	54.16	54.99
Pronto+Spanco+ Tamnut 74	46.56	46.33	45.23	45.62	45.94
Pronto+Spanco	48.53	47.67	47.25	47.52	47.74
Tamnut 74	42.64	43.66	41.20	41.84	42.33

in a row quadratic response of the two trends in this row spacing range.

Row spacing produced small but statistically significant differences for 100 seed weight in 1982 (Tables 15 and 18). Decreasing row spacing from 'wide' to 'intermediate' resulted in very little decrease in 100 seed weight but a larger reduction was observed from the 'narrow' rows (Table 18). Although 100 seed weight tended to decrease when row spacing changed from 'wide' to 'narrow', the effect was observed to be less at 'low' than at other plant densities. This implied that, at 'low' plant density, factors needed for plant growth and seed production may not reach their limiting levels. In contrast, at 'medium' and 'high' plant densities, those factors become more limited, resulting in smaller seed weights. The progressively larger difference of 100 seed weight produced by 'wide' and 'narrow' rows with increased plant density provided supporting evidence.

In contrast to row spacing, increased plant density from 'low' to 'high' resulted in a quadratic effect on 100 seed weight with the peak reached at 'medium' plant density (Table 18). This suggested that increasing plant density to 'medium' or 'high' did not cause growth factors to become limiting for seed weight expression. It is possible that an increase in plant density could result in better plant establishment and higher efficiency in utilization of water and nutrients. However, the effect of plant density on 100 seed weight had an OSL of 11% (Table 15).

The row spacing x plant density interaction had an OSL of 7% in 1982 (Table 15). The largest seed weights were produced at 'high' plant density for 'wide' rows, 'medium' plant density for 'intermediate' as well as for 'twin' rows, and 'low' plant density for 'narrow' rows (Table 18).

TABLE 18

MEAN 100 SEED WEIGHTS AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	g			
Wide	48.02	48.84	49.49	48.78
Intermediate	47.76	49.28	49.04	48.69
Narrow	48.30	47.86	46.56	47.58
Twin	47.40	48.95	46.93	47.76
Mean	47.87	48.73	48.00	48.20

Other Kernels (OK)

There were significant differences among cultivars for percentages of OK in both years studied (Tables 19 and 20). In 1981, Spanco produced the highest percentage of OK, while Pronto had the lowest percentage of OK (Table 21). The percentage of OK produced by Pronto and Spanco were statistically different at row spacings from 'wide' to 'narrow' (Table 19). The %OK of Pronto tended to increase with the decrease in row spacing from 'wide' to 'narrow', while the reverse situation occurred in Spanco (Table 21). However, exceptional trends were observed at 'intermediate' rows for both Pronto and Spanco (Table 21), causing statistical differences between OK produced when row spacing changed from 'wide' to 'intermediate', and to 'narrow' rows (Table 19).

TABLE 19

ANALYSIS OF VARIANCE FOR OTHER KERNELS, 1981

Source*	F Value	OSL
Cultivar	17.15	<0.01
PS-T	10.27	0.02
P-S	40.98	<0.01
PS-T x Row Quadratic	2.36	0.13
P-S x Row Linear	2.97	0.09
P-S x Row Quadratic	2.37	0.13
PST-F x Plant Linear	3.52	0.06
Row Spacing x Plant Density	2.21	0.05
Row Linear x Plant Quadratic	6.40	<0.01
Narrow-Twin x Plant Linear	2.70	0.10

*All sources of variation having an OSL of 15% or larger have been excluded from this table.

TABLE 20

ANALYSIS OF VARIANCE FOR OTHER KERNELS, 1982

Source*	F Value	OSL
Cultivar	1017.13	<0.01
PST-F	3017.19	<0.01
PS-T	23.77	<0.01
P-S	10.45	<0.01
Row Spacing	2.39	0.07
Row Linear	2.79	0.10
Row Quadratic	4.00	0.05
Plant Density	1.88	0.16
Plant Quadratic	3.51	0.06
PS-T x Row Linear	3.45	0.07
PS-T x Narrow-Twin	2.71	0.10
Cultivar x Plant Density	2.40	0.03
PST-F x Plant Quadratic	9.47	<0.01
Cultivar x Row Spacing x Plant Density	1.47	0.11

*All sources of variation having an OSL of 18% or larger have been excluded from this table.

TABLE 21

MEAN OTHER KERNELS OF PEANUT CULTIVARS
AT VARIOUS ROW SPACINGS, 1981

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	%				
Florunner	2.43	2.40	2.30	2.87	2.50
Pronto	1.91	1.77	2.50	1.62	1.95
Spanco	4.07	4.31	3.27	3.46	3.78
Tamnut 74	2.03	1.35	2.33	2.57	2.07
Mean	2.61	2.46	2.60	2.63	2.57
Pronto+Spanco	2.99	3.04	2.88	2.54	2.86
Tamnut 74	2.03	1.35	2.33	2.57	2.07

Tamnut 74 produced a smaller percentage of OK than the average of Pronto and Spanco (Table 21). When row spacing changed from 'wide' to 'narrow', the percentage of OK tended to decrease in Pronto with Spanco but tended to increase in Tamnut 74. The exceptional high and low percentages, however, were observed at 'intermediate' rows while the least difference was observed at 'narrow' rows (Table 21).

Although no statistical differences were obtained for OK produced by Florunner and the spanish cultivars in 1981, the OK production trends were statistically different at the 6% OSL when plant density changed from 'low' to 'high' (Table 19). Florunner produced the largest percentage of OK at 'low' plant density and declined with increased plant density. In contrast, the spanish cultivars had fewer OK at the 'low' plant density and increased with increased plant density (Table 22).

TABLE 22

MEAN OTHER KERNELS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1981

Cultivar	Plant Density			Mean
	Low	Medium	High	
	%			
Florunner	2.86	2.63	2.01	2.50
Pronto	1.86	1.86	2.16	1.95
Spanco	3.63	3.66	4.05	3.78
Tamnut 74	1.94	2.35	1.92	2.07
Mean	2.57	2.62	2.52	2.57
Florunner	2.86	2.63	2.01	2.50
Pronto+Spanco+Tamnut 74	2.47	2.62	2.71	2.60

In comparing 'narrow' and 'twin' rows in 1981, an interaction was observed (OSL 10%) with plant density from 'low' to 'high' (Table 19). The %OK tended to increase with increased plant density in 'narrow' rows but declined in 'twin' rows (Table 23). The highest %OK was produced by 'narrow' rows at 'medium' plant density, but by 'twin' rows at 'low' plant density.

TABLE 23

MEAN OTHER KERNELS AT VARIOUS SPATIAL ARRANGEMENTS, 1981

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	---	%	---	
Wide	2.77	2.25	2.81	2.61
Intermediate	2.24	2.26	2.87	2.46
Narrow	2.19	3.26	2.34	2.60
Twin	3.09	2.72	2.08	2.63
Mean	2.57	2.62	2.52	2.57

In 1982, Florunner produced the largest percentage of OK and larger than the average of the spanish cultivars while Pronto produced the least (Table 24). Among the spanish cultivars, Tamnut 74 yielded statistically higher OK than the average of Pronto and Spanco, and Pronto and Spanco were also statistically different (Tables 20 and 24).

Several interactions were observed between the cultivar comparison and row spacing and/or plant density (Table 20). In looking at the row spacing effects on the comparison of Pronto and Spanco vs. Tamnut 74, the %OK tended to increase when going from 'wide' to 'narrow' rows but at a much higher rate for Tamnut 74. Both had a similar quadratic effect with the lowest %OK at 'intermediate' rows (Table 24). The Pronto and Spanco vs. Tamnut 74 comparison also exhibited an interaction with 'narrow' and 'twin' rows at an OSL of 10% (Table 20). Pronto and Spanco remained essentially the same in %OK in 'narrow' and 'twin' rows while Tamnut 74 showed a great reduction in %OK in the 'twin' rows. However, when considering the individual data for Pronto and Spanco, Pronto had less %OK in 'twin' rows and Spanco had a higher %OK in 'twin' rows when compared to 'narrow' rows. Thus, the average of the two stayed relatively unchanged. When studying the data for Tamnut 74, it appears that an abnormally high %OK was obtained from 'narrow' rows which is difficult to explain.

TABLE 24

MEAN OTHER KERNELS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1982

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	%				
Florunner	8.29	7.64	7.98	8.38	8.07
Pronto	1.09	0.99	1.40	0.79	1.07
Spanco	1.32	0.94	1.73	2.17	1.54
Tamnut 74	1.35	1.19	3.34	1.80	1.92
Mean	3.01	2.69	3.61	3.28	3.15
Florunner	8.29	7.64	7.98	8.38	8.07
Pronto+Spanco+ Tamnut 74	1.25	1.04	2.15	1.58	1.51
Pronto+Spanco	1.20	0.96	1.56	1.48	1.30
Tamnut 74	1.35	1.19	3.34	1.80	1.92

In the 1982 comparison of Florunner with the three spanish cultivars, an interaction was observed with plant density (Table 20). As seen in Table 25, Florunner exhibited a substantial quadratic response to plant density with the low value for %OK occurring at 'medium' plant density while the average of the three spanish cultivars showed a linear trend with OK values increasing with higher plant densities.

TABLE 25

MEAN OTHER KERNELS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1982

Cultivar	Plant Density			Mean
	Low	Medium	High	
	%			
Florunner	8.86	6.78	8.58	8.07
Pronto	1.13	1.07	1.00	1.07
Spanco	1.69	1.08	1.85	1.54
Tamnut 74	1.28	2.33	2.16	1.92
Mean	3.24	2.81	3.40	3.15
Florunner	8.86	6.78	8.58	8.07
Pronto+Spanco+Tamnut 74	1.36	1.49	1.67	1.51

In 1982, row spacing influenced production of OK with an OSL of 7% (Table 20). Linear and quadratic responses to row spacing were observed at OSLs of 10 and 5%, respectively. Although there was an upward linear trend in %OK from 'wide' to 'narrow' rows, there was a sizeable quadratic effect with lower %OK in 'intermediate' rows (Table 25).

Plant density affected %OK production in the 1982 season at the OSL of 16% (Table 20). Changing plant density from 'low' to 'high' resulted in a quadratic response for %OK at an OSL of 6% with the lowest OK value produced by the 'medium' plant density (Table 25).

There were also cultivar x plant density and cultivar x row spacing x plant density interactions for OK production at OSLs of 3 and 11%, respectively (Table 20). The lowest percentages for each of these cultivars were produced at 'intermediate' to 'twin' rows and with 'medium' or 'high' plant densities (Table 26).

The results from the two years studied (Tables 22 and 24) indicated that Spanco produced the highest %OK in 1981 while Florunner did in 1982. Pronto, however, produced the lowest %OK in both years. The %OK of the spanish cultivars decreased in the 1982 season which favored the spanish type in general. In contrast, the %OK of Florunner increased drastically in the shorter season of 1982. Therefore, the variation of the %OK in the two years seemed to be partially influenced by the varying growing seasons. In 1981, Florunner reached its optimum growth better than in 1982, resulting in lower %OK (2.50 vs. 8.07). Meanwhile, the longer season of 1981 may have been unfavorable for the spanish cultivars. Harvesting after optimum maturity may have caused loss of the more mature pods in the ground at harvest as mentioned in the previous section and a corresponding increase in %OK. The data suggest that decreased row spacing as well as increased plant density did not cause negative effects for OK production. Additionally, narrowing row spacing from 'wide' to 'intermediate' resulted in lower %OK production. Similarly, increasing plant density from 'low' to 'medium' relatively stabilized the OK production.

TABLE 26

MEAN OTHER KERNELS OF PEANUT CULTIVARS AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Cultivar	Row Spacing	Plant Density		
		Low	Medium	High
			%	
Florunner	Wide	10.81	7.20	6.86
Pronto		0.56	1.36	1.36
Spanco		1.51	1.15	1.32
Tamnut 74		1.08	1.00	1.97
Florunner	Intermediate	7.60	5.97	9.35
Pronto		0.81	1.17	1.00
Spanco		0.83	0.83	1.16
Tamnut 74		0.91	2.07	0.60
Florunner	Narrow	8.53	5.68	9.73
Pronto		1.95	1.20	1.06
Spanco		2.11	1.13	1.95
Tamnut 74		1.43	5.03	3.56
Florunner	Twin	8.51	8.26	8.37
Pronto		1.22	0.55	0.60
Spanco		2.30	1.22	2.98
Tamnut 74		1.70	1.21	2.51

Damaged Kernels (DMK)

Peanut cultivars differed statistically for %DMK, however, the OSL was only 9% in 1982 (Tables 27 and 28).

In 1981, Pronto yielded the smallest %DMK but did not statistically differ from the other spanish cultivars (Table 29). Florunner produced statistically more DMK than did the spanish cultivars. The DMK of Florunner decreased as row spacing changed from 'wide' to 'narrow'. However, for the spanish cultivars, DMK declined when row spacing changed from 'wide' to 'intermediate', then increased again in the 'narrow' rows (Table 29). These linear and quadratic responses to row spacing of Florunner vs. the spanish cultivars were obtained at high levels of probability (Table 27). The production of DMK tended to decline in both Florunner and the spanish cultivars as plant density increased from 'low' to 'high'. However, the highest %DMK for Florunner and the lowest %DMK for the spanish cultivars were observed at 'medium' plant density (Table 30). This resulted in the significant PST-F x Plant Quadratic response noted in Table 27.

Cultivar x row spacing and cultivar x plant density interactions were also observed in 1981 (Table 27). The lowest %DMK were produced at 'intermediate' rows for Pronto and Spanco, at 'wide' rows for Tamnut 74, and at 'narrow' rows for Florunner (Table 29). Florunner and Tamnut 74 had their lowest %DMK at 'high' plant density while Pronto and Spanco had their lowest %DMK at 'medium' and 'low' plant

TABLE 27

ANALYSIS OF VARIANCE FOR DAMAGED KERNELS, 1981

Source*	F Value	OSL
Cultivar	6.06	<0.01
PST-F	16.19	<0.01
Cultivar x Row Spacing	1.82	0.07
PST-F x Row Linear	8.06	<0.01
PST-F x Row Quadratic	5.90	0.02
Cultivar x Plant Density	1.90	0.09
PST-F x Plant Quadratic	7.74	<0.01

*All sources of variation having an OSL of 15% or larger have been excluded from this table.

TABLE 28

ANALYSIS OF VARIANCE FOR DAMAGED KERNELS, 1982

Source*	F Value	OSL
Cultivar	2.18	0.09
PST-F	4.87	0.09
Row Spacing	1.94	0.13
Narrow-Twin	2.66	0.11
PS-T x Narrow-Twin	8.47	<0.01
PS-T x Plant Linear	5.01	0.03
Narrow-Twin x Plant Linear	3.63	0.06

*All sources of variation having an OSL of 18% or larger have been excluded from this table.

TABLE 29

MEAN DAMAGED KERNELS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1981

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	%				
Florunner	3.45	3.08	1.85	2.30	2.67
Pronto	1.60	1.49	1.95	1.60	1.66
Spanco	2.16	1.77	2.35	1.85	2.03
Tamnut 74	1.76	2.01	2.15	2.08	2.00
Mean	2.24	2.09	2.08	1.96	2.09
Florunner	3.45	3.08	1.85	2.30	2.67
Pronto+Spanco+ Tamnut 74	1.84	1.75	2.15	1.84	1.89

TABLE 30

MEAN DAMAGED KERNELS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1981

Cultivar	Plant Density			Mean
	Low	Medium	High	
	%			
Florunner	2.78	3.15	2.08	2.67
Pronto	1.69	1.40	1.89	1.66
Spanco	1.93	2.03	2.13	2.03
Tamnut 74	2.32	2.03	1.65	2.00
Mean	2.18	2.15	1.94	2.09
Florunner	2.78	3.15	2.08	2.67
Pronto+Spanco+Tamnut 74	1.98	1.82	1.89	1.89

density, respectively (Table 30).

In 1982, significant differences in DMK were observed for peanut cultivars at an OSL of 9% (Table 28). Florunner produced the lowest percentage and was thus lower than the spanish cultivars' average (Table 31). There was no statistical difference between %DMK produced by Pronto and Spanco vs. Tamnut 74 when averaged over row spacings and plant densities. However, the interaction with plant density was statistically significant (Table 28). Pronto and Spanco produced fewer DMK kernels than Tamnut 74 with a trend of increasing %DMK as plant density increased (Table 32). In contrast, Tamnut 74 declined in %DMK as plant density increased, but had the smallest %DMK at 'medium' plant density (Table 32). Similarly, the DMK produced were different at 'narrow' and 'twin' rows (Table 31). Tamnut 74 yielded less DMK at 'narrow' rows, while Pronto and Spanco had less at the twin row spacing.

Row patterns appeared to influence DMK production more in 1982 than in 1981 even though much less damage was observed in 1982 (Tables 27, 28, 29, and 33). 'Twin' rows produced more DMK than 'narrow' rows at an OSL of 11%. However, the production of DMK in 'twin' vs. 'narrow' rows was also influenced by plant density with almost no DMK observed in 'narrow' rows at 'low' plant density (Tables 28 and 33).

In the two years studied, Pronto had the least DMK, and the spanish cultivars produced less DMK than Florunner in

TABLE 31

MEAN DAMAGED KERNELS OF PEANUT CULTIVARS
AT VARIOUS ROW SPACINGS, 1982

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	%				
Florunner	0.00	0.04	0.07	0.30	0.10
Pronto	0.23	0.34	0.34	0.16	0.27
Spanco	0.19	0.20	0.25	0.23	0.21
Tamnut 74	0.14	0.27	0.17	0.77	0.34
Mean	0.14	0.21	0.21	0.36	0.23
Florunner	0.00	0.04	0.07	0.30	0.10
Pronto+Spanco+ Tamnut 74	0.19	0.27	0.26	0.39	0.28
Pronto+Spanco	0.21	0.27	0.29	0.19	0.24
Tamnut 74	0.14	0.27	0.17	0.77	0.34

TABLE 32

MEAN DAMAGED KERNELS OF PEANUT CULTIVARS
AT VARIOUS PLANT DENSITIES, 1982

Cultivar	Plant Density			Mean
	Low	Medium	High	
	---------------	%	---------------	
Florunner	0.03	0.22	0.05	0.10
Pronto	0.15	0.27	0.38	0.27
Spanco	0.14	0.28	0.23	0.21
Tamnut 74	0.55	0.21	0.25	0.34
Mean	0.21	0.24	0.23	0.23
Florunner	0.03	0.22	0.05	0.10
Pronto+Spanco+Tamnut 74	0.28	0.25	0.28	0.27
Pronto+Spanco	0.14	0.27	0.30	0.24
Tamnut 74	0.55	0.21	0.25	0.34

TABLE 33

MEAN DAMAGED KERNELS AT VARIOUS
SPATIAL ARRANGEMENTS, 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	---------------	%	---------------	
Wide	0.10	0.16	0.16	0.14
Intermediate	0.25	0.16	0.24	0.21
Narrow	0.04	0.32	0.26	0.21
Twin	0.48	0.35	0.26	0.36
Mean	0.21	0.24	0.23	0.23

1981. In the shorter season of 1982, however, Florunner produced the smallest percentage. The %DMK produced in 1981 was also comparatively higher than in 1982. Therefore, the variation in %DMK seemed to be partially influenced by the seasonal conditions. In the long season of 1981, peanut cultivars (probably all) passed their optimum maturity and were exposed longer to soil moisture and other factors causing seed damage than in 1982. In contrast, in 1982, the optimum growth peaks of the spanish cultivars may have been realized while Florunner was still slightly immature which generally results in less DMK. Favorable weather during harvest in 1982 probably accounted for the overall less damage in that year. For row patterns, only the 'twin' vs. 'narrow' row comparison gave a statistically significant difference in %DMK. Also, this was obtained only in 1982 and at an OSL of 11%. Therefore, narrowing row spacing from 'wide' to 'narrow' and probably also 'twin' rows seems unlikely to have negative effects on damaged kernel production.

Sound Splits (SS)

There were significant differences for SS produced by peanut cultivars in the two years studied (Tables 34 and 35). Consistently, spanish peanuts produced higher percentages of SS than Florunner and Tamnut 74 produced more SS than Pronto and Spanco (Tables 36 and 37). There was no statistical difference between %SS produced by Pronto and

TABLE 34

ANALYSIS OF VARIANCE FOR SOUND SPLITS, 1981

Source*	F Value	OSL
Cultivar	8.93	<0.01
PST-F	8.71	0.05
PS-T	14.92	0.02

*All sources of variation having an OSL of 15% or larger have been excluded from this table.

TABLE 35

ANALYSIS OF VARIANCE FOR SOUND SPLITS, 1982

Source*	F Value	OSL
Cultivar	96.51	<0.01
PST-F	280.67	<0.01
PS-T	7.14	0.06
Plant Density	4.31	0.02
Plant Linear	8.62	<0.01
P-S x Row Linear	4.84	0.03
PST-F x Plant Linear	2.37	0.13
Row Linear x Plant Linear	2.66	0.11
Cultivar x Row Spacing x Plant Density	1.52	0.09

*All sources of variation having an OSL of 21% or larger have been excluded from this table.

TABLE 36

MEAN SOUND SPLITS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1981

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	----------------------	--------	-% -------	----------	----------
Florunner	7.57	8.62	8.02	9.67	8.47
Pronto	11.76	7.82	10.56	10.87	10.25
Spanco	9.58	8.18	7.60	9.86	8.80
Tamnut 74	13.12	12.83	11.61	11.50	12.26
Mean	10.51	9.36	9.45	10.47	9.95
Florunner	7.57	8.62	8.02	9.67	8.47
Pronto+Spanco+ Tamnut 74	11.48	9.61	9.92	10.74	10.43
Pronto+Spanco	10.67	8.00	9.08	10.36	9.52
Tamnut 74	13.12	12.83	11.61	11.50	12.26

TABLE 37

MEAN SOUND SPLITS OF PEANUT CULTIVARS
AT VARIOUS ROW SPACINGS, 1982

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
Florunner	1.01	1.27	1.32	1.19	1.20
Pronto	4.67	4.28	5.05	4.53	4.63
Spanco	6.12	4.71	4.75	4.42	5.00
Tamnut 74	5.72	5.47	5.20	5.45	5.47
Mean	4.38	3.94	4.08	3.90	4.07
Florunner	1.01	1.27	1.32	1.19	1.20
Pronto+Spanco+ Tamnut 74	5.50	4.86	5.00	4.80	5.03
Pronto+Spanco	5.39	4.49	4.90	4.47	4.81
Tamnut 74	5.72	5.47	5.20	5.45	5.47

Spanco in either year. However, interactions between cultivar and row spacing, and cultivar and plant density were observed in 1982 (Table 35). Sound splits obtained from Pronto and Spanco were influenced by spacing (Table 37). Pronto tended to produce more SS as row spacing decreased from 'wide' to 'narrow', but the reverse condition was found with Spanco. However, the lowest %SS for Pronto was observed at 'intermediate' rows. The largest difference in %SS between Pronto and Spanco occurred at 'wide' rows (Table 37). Sound splits of Florunner tended to decrease as plant density increased from 'low' to 'high' although the highest %SS was obtained from 'medium' plant density (Table 38). Spanish cultivars declined in %SS with increased plant density. This resulted in the largest difference in SS being produced at 'low' plant density.

The main effects of plant density on %SS were statistically significant in 1982 and a linear response to plant density was observed with %SS declining with increased plant density (Tables 35 and 38).

The interaction of row linear x plant linear was observed in 1982 at an OSL of 11% (Table 35). Although the %SS tended to decline with decreased row spacing from 'wide' to 'narrow' and with increased plant density from 'low' to 'high', exceptions were observed with higher %SS at 'low' plant density in 'narrow' rows, and at 'medium' plant density in 'wide' rows (Table 39). Similarly, the peanut cultivar x row spacing x plant density interaction was

TABLE 38

MEAN SOUND SPLITS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1982

Cultivar	Plant Density			Mean
	Low	Medium	High	
	---------------%			----------------
Florunner	1.14	1.37	1.08	1.20
Pronto	5.17	4.62	4.11	4.63
Spanco	5.17	5.00	4.83	5.00
Tamnut 74	6.27	5.25	4.88	5.47
Mean	4.44	4.06	3.72	4.07
Florunner	1.14	1.37	1.08	1.20
Pronto+Spanco+Tamnut 74	5.53	4.95	4.60	5.03
Pronto+Spanco	5.17	4.81	4.47	4.81
Tamnut 74	6.27	5.25	4.88	5.47

TABLE 39

MEAN SOUND SPLITS AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	---------------%			----------------
Wide	4.36	4.74	4.05	4.38
Intermediate	4.15	3.83	3.83	3.94
Narrow	4.82	4.03	3.40	4.08
Twin	4.41	3.65	3.62	3.90
Mean	4.44	4.06	3.72	4.07

observed in 1982 at an OSL of 9% (Table 35). Florunner produced the least SS at 'low' plant density in 'intermediate' rows. The spanish cultivars, on the other hand, produced the least SS at higher plant densities or in narrower rows (Table 40).

TABLE 40

MEAN SOUND SPLITS OF PEANUT CULTIVARS AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Cultivar	Row Spacing	Plant Density		
		Low	Medium	High
			%	
Florunner	Wide	0.96	0.87	1.20
Pronto		4.83	5.32	3.87
Spanco		6.30	6.81	5.27
Tamnut 74		5.35	5.95	5.88
Florunner	Intermediate	0.81	1.71	1.28
Pronto		5.37	3.58	3.88
Spanco		4.96	4.41	4.76
Tamnut 74		5.48	5.61	5.38
Florunner	Narrow	1.41	1.63	0.91
Pronto		6.03	4.12	5.00
Spanco		4.76	4.88	4.62
Tamnut 74		7.08	5.47	3.06
Florunner	Twin	1.40	1.26	0.92
Pronto		4.43	5.47	3.68
Spanco		4.67	3.90	4.68
Tamnut 74		7.16	4.00	5.18

From the results of the two years studied, peanut cultivars produced SS in a relatively consistent manner.

Florunner had the smallest numbers of SS in both years while Pronto and Spanco had less SS than Tamnut 74 in both years. There was no statistical difference between the %SS produced by similar genotype peanut cultivars, Pronto and Spanco.

Plant density affected SS only in 1982. However, the trends in the two years were similar with fewer SS produced as plant density increased (Tables 39 and 41). Also, decreasing percentages of SS were observed as row spacing decreased from 'wide' to 'narrow' rows in the two seasons although there was no significant difference among row spacings. Therefore, increased plant density as well as decreased row spacing in the ranges studied seemed to have no detrimental effects on the production of SS.

TABLE 41

MEAN SOUND SPLITS AT VARIOUS SPATIAL ARRANGEMENTS, 1981

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	%			
Wide	10.32	10.94	10.26	10.50
Intermediate	9.35	8.28	10.47	9.36
Narrow	11.02	8.98	8.35	9.45
Twin	11.70	10.38	9.33	10.47
Mean	10.59	9.64	9.60	9.94

Sound Mature Kernels (SMK)

Peanut cultivars produced significantly different SMK in both years studied (Tables 42 and 43). Florunner yielded the highest %SMK in the long growing season of 1981 and was significantly higher than the average of the spanish cultivars (Tables 42 and 44). In 1982, Pronto produced the highest %SMK and the %SMK averaged from the spanish cultivars was higher than Florunner (Table 45). Among the spanish cultivars, Pronto and Spanco averaged more SMK than Tamnut 74 but the difference was statistically significant only in 1982. However, the PS-T x Plant Quadratic interaction was obtained in 1981 (Tables 42 and 46). Opposite quadratic responses to plant density were obtained from the Pronto and Spanco average as compared to Tamnut 74 (Table 46). Pronto produced significantly higher %SMK than Spanco in the two years studied (Tables 42, 43, 44, and 45). However, the SMK production of Pronto and Spanco interacted with plant density in 1981 (Table 42). Pronto exhibited a substantial quadratic response with higher SMK resulting from 'medium' plant density while Spanco exhibited a very modest linear response of increasing SMK from increasing plant density (Table 46). A similar interaction was also observed in row patterns (Table 42). Pronto as well as Spanco had an increasing trend of SMK production with decreased row spacing from 'wide' to 'narrow' (Table 44). However, Pronto again exhibited a substantial quadratic effect with more SMK at 'intermediate' rows.

TABLE 42

ANALYSIS OF VARIANCE FOR SOUND MATURE KERNELS, 1981

Source*	F Value	OSL
Cultivar	32.46	<0.01
PST-F	72.24	<0.01
P-S	25.04	<0.01
P-S x Row Quadratic	3.57	0.06
Cultivar x Plant Density	1.96	0.08
PS-T x Plant Quadratic	6.50	0.01
P-S x Plant Quadratic	3.86	0.05

*All sources of variation having an OSL of 13% or larger have been excluded from this table.

TABLE 43

ANALYSIS OF VARIANCE FOR SOUND MATURE KERNELS, 1982

Source*	F Value	OSL
Cultivar	86.40	<0.01
PST-F	129.16	<0.01
PS-T	42.77	<0.01
P-S	87.26	<0.01
Row Spacing	2.05	0.11
Row Quadratic	4.48	0.04
Plant Density	2.06	0.13
Plant Quadratic	3.79	0.05
P-S x Row Quadratic	2.32	0.13
PST-F x Plant Quadratic	7.28	<0.01

*All sources of variation having an OSL of 16% or larger have been excluded from this table.

TABLE 44

MEAN SOUND MATURE KERNELS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1981

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	%				
Florunner	65.05	64.39	67.24	64.29	65.24
Pronto	59.06	64.01	59.75	59.97	60.70
Spanco	53.60	55.02	56.89	56.41	55.48
Tamnut 74	58.06	57.65	57.39	58.25	57.84
Mean	58.94	60.27	60.32	59.73	59.81
Florunner	65.05	64.39	67.24	64.29	65.24
Pronto+Spanco+ Tamnut 74	56.90	58.89	58.01	58.21	58.00
Pronto+Spanco	56.33	59.51	58.34	58.19	58.09
Tamnut 74	58.06	57.65	57.39	58.25	57.84

TABLE 45

MEAN SOUND MATURE KERNELS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1982

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	%				
Florunner	61.61	62.50	61.62	60.47	61.55
Pronto	68.91	68.22	66.83	68.55	68.13
Spanco	63.60	66.34	63.25	63.80	64.25
Tamnut 74	63.87	64.38	63.08	64.01	63.84
Mean	64.50	65.36	63.70	64.21	64.44
Florunner	61.61	62.50	61.62	60.47	61.55
Pronto+Spanco+ Tamnut 74	65.46	66.31	64.38	65.45	65.40
Pronto+Spanco	66.25	67.28	65.04	66.17	66.19
Tamnut 74	63.87	64.38	63.08	64.01	63.84

TABLE 46

MEAN SOUND MATURE KERNELS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1981

Cultivar	Plant Density			Mean
	Low	Medium	High	
	%			
Florunner	65.00	64.39	66.34	65.24
Pronto	58.65	63.54	59.90	60.70
Spanco	55.08	55.42	55.93	55.48
Tamnut 74	58.86	55.98	58.67	57.84
Mean	59.40	59.83	60.21	59.81
Pronto+Spanco	56.86	59.48	57.91	58.09
Tamnut 74	58.86	55.98	58.67	57.84

In 1982, Pronto and Spanco each had declining trends of SMK production when row spacing changed from 'wide' to 'narrow', however, Spanco exhibited the quadratic response with higher SMK at 'intermediate' rows (Table 45). This interaction had an OSL of 13% (Table 43). Florunner and the spanish cultivars interacted with plant densities in 1982 (Table 43). Changing plant density essentially had no effect on SMK production in the spanish cultivars, but Florunner exhibited a substantial quadratic response with higher SMK resulting from 'medium' plant density (Table 47).

TABLE 47

MEAN SOUND MATURE KERNELS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1982

Cultivar	Plant Density			Mean
	Low	Medium	High	
	%			
Florunner	60.79	63.83	60.03	61.55
Pronto	67.90	67.80	68.69	68.13
Spanco	64.19	64.68	63.88	64.25
Tamnut 74	64.23	64.14	63.14	63.84
Mean	64.28	65.11	63.93	64.44
Florunner	60.79	63.83	60.03	61.55
Pronto+Spanco+Tamnut 74	65.44	65.54	65.23	65.40

In 1982, the main effects of row spacing and plant densities on SMK production had OSLs of 11 and 13%, respectively (Table 43). Both row spacings and plant densities exhibited quadratic responses with higher SMK resulting from 'intermediate' rows and 'medium' plant density, respectively (Tables 45 and 47).

From the results obtained, spanish peanut cultivars produced SMK relatively consistently. Pronto yielded more SMK than Spanco, and Pronto averaged with Spanco yielded more SMK than Tamnut 74. Florunner was favored by the long growing season of 1981 while the spanish cultivars were favored by the shorter season in 1982. This resulted in a higher mean percentage of SMK for Florunner in 1981 and for the spanish cultivars in 1982. Row spacing and plant density primarily affected SMK production only in 1982. Both exhibited quadratic responses with higher SMK resulting from 'intermediate' rows and 'medium' plant density.

Total Sound Mature Kernels (TSMK)

Peanut cultivars were statistically different for percentage of TSMK in both years studied (Tables 48 and 49). In 1981, Florunner produced the highest percentage of TSMK and also statistically higher than the average of the spanish cultivars (Tables 48 and 50). The TSMK production of Florunner and the spanish cultivars also depended on row spacing (Table 48). Florunner produced more TSMK as row spacing decreased from 'wide' to 'narrow', but TSMK was relatively unaffected by row spacing for the spanish cultivars (Table 50). Florunner and the spanish cultivars also responded differently to plant density (Table 48). The TSMK tended to increase as plant density increased from 'low' to 'high' in Florunner, but tended to decline in the spanish cultivars resulting in the largest difference at 'high' plant density (Table 51). This interaction had an OSL of 9% (Table 48). The cultivar x plant density interaction was also significant at an OSL of 3% (Table 48). Florunner and Tamnut 74 produced their highest %TSMK at 'high' plant density while Pronto and Spanco produced their highest percentages at 'medium' and 'low' plant density, respectively (Table 51).

TABLE 48

ANALYSIS OF VARIANCE FOR TOTAL SOUND MATURE KERNELS, 1981

Source*	F Value	OSL
Cultivar	45.73	<0.01
PST-F	60.52	<0.01
PS-T	11.99	<0.01
P-S	64.68	<0.01
PST-F x Row Linear	2.56	0.11
Cultivar x Plant Density	2.44	0.03
PST-F x Plant Linear	2.91	0.09
PS-T x Plant Quadratic	3.94	0.05
P-S x Plant Quadratic	5.20	0.02

*All sources of variation having an OSL of 16% or larger have been excluded from this table.

TABLE 49

ANALYSIS OF VARIANCE FOR TOTAL SOUND MATURE KERNELS, 1982

Source*	F Value	OSL
Cultivar	295.17	<0.01
PST-F	748.83	<0.01
PS-T	32.62	<0.01
P-S	104.06	<0.01
Row Spacing	2.03	0.11
Row Linear	2.55	0.11
Row Quadratic	2.61	0.11
Plant Density	3.37	0.04
Plant Linear	3.11	0.08
Plant Quadratic	3.63	0.06
Cultivar x Plant Density	1.94	0.08
PST-F x Plant Quadratic	8.99	<0.01

*All sources of variation having an OSL of 16% or larger have been excluded from this table.

TABLE 50

MEAN TOTAL SOUND MATURE KERNELS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1981

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	%				
Florunner	72.62	73.02	75.27	73.96	73.71
Pronto	70.82	71.83	70.32	70.85	70.95
Spanco	63.19	63.21	64.49	66.27	64.28
Tamnut 74	71.19	70.49	69.00	69.75	70.10
Mean	69.45	69.63	69.77	70.20	69.76
Florunner	72.62	73.02	75.27	73.96	73.71
Pronto+Spanco+ Tamnut 74	68.40	68.51	67.93	68.95	68.44

Among the spanish peanut cultivars, Tamnut 74 produced more TSMK than Pronto and Spanco, however, they also interacted with plant density (Tables 48 and 51). Production of TSMK tended to increase in Tamnut 74 but decreased in the Pronto and Spanco as plant density changed from 'low' to 'high'. However, reverse TSMK production trends were observed in the plant density range of 'low' to 'medium', which, in turn, resulted in the PS-T x Plant Quadratic interaction. In comparing Pronto and Spanco, Pronto produced considerably more TSMK than Spanco. The TSMK production tended to decrease in both cultivars when plant density increased from 'low' to 'high'. However, Pronto exhibited a quadratic response with higher TSMK at 'medium' plant density.

TABLE 51

MEAN TOTAL SOUND MATURE KERNELS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1981

Cultivar	Plant Density			Mean
	Low	Medium	High	
	%			
Florunner	73.27	72.62	75.25	73.71
Pronto	70.39	72.98	69.49	70.95
Spanco	65.68	63.59	63.58	64.28
Tamnut 74	70.64	68.73	70.94	70.10
Mean	69.99	69.48	69.81	69.76
Florunner	73.27	72.62	75.25	73.71
Pronto+Spanco+Tamnut 74	68.90	68.43	68.00	68.44
Pronto+Spanco	68.03	68.28	66.53	67.61
Tamnut 74	70.64	68.73	70.94	70.10

In 1982, Pronto yielded the highest percentage of TSMK and was significantly different from Spanco (Table 52). The spanish cultivars each produced more TSMK than the Florunner cultivar and, as a group, were statistically higher (Tables 49 and 52). The production of TSMK for both spanish cultivars and Florunner tended to decline with increased plant density from 'low' to 'high', but with an exceptional increase in Florunner at 'medium' plant density resulting in the significant PST-F x Plant Quadratic interaction (Tables 49 and 53). Pronto and Spanco yielded a higher percentage of TSMK than did Tamnut 74 (Tables 49 and 53).

TABLE 52

MEAN TOTAL SOUND MATURE KERNELS OF PEANUT CULTIVARS AT VARIOUS ROW SPACINGS, 1982

Cultivar	Row Spacing				Mean
	Wide	Intermediate	Narrow	Twin	
	%				
Florunner	62.62	63.77	62.94	61.66	62.75
Pronto	73.58	72.50	71.88	73.08	72.76
Spanco	69.72	68.05	68.00	68.22	69.25
Tamnut 74	69.59	69.87	68.28	69.46	69.31
Mean	68.88	69.30	67.78	68.11	68.51
Florunner	62.62	63.77	62.94	61.66	62.75
Pronto+Spanco+ Tamnut 74	70.96	70.14	69.39	70.25	70.44

Row spacing affected production of TSMK but at an OSL of 11% (Table 49). 'Intermediate' rows yielded the highest percentage of TSMK even though TSMK declined when row spacing decreased from 'wide' to 'narrow'. These quadratic and linear responses were both associated with OSLs of 11% (Tables 49 and 52).

TABLE 53

MEAN TOTAL SOUND MATURE KERNELS OF PEANUT CULTIVARS AT VARIOUS PLANT DENSITIES, 1982

Cultivar	Plant Density			Mean
	Low	Medium	High	
	%			
Florunner	61.93	65.20	61.11	62.75
Pronto	73.07	72.42	72.80	72.76
Spanco	69.36	69.68	68.71	69.25
Tamnut 74	70.50	69.39	68.02	69.31
Mean	68.72	69.17	67.66	68.51
Florunner	61.93	65.20	61.11	62.75
Pronto+Spanco+Tamnut 74	70.97	70.49	69.84	70.44
Pronto+Spanco	71.21	71.05	70.75	71.00
Tamnut 74	70.50	69.39	68.02	69.31

For plant density, there was a decreasing trend of TSMK production when plant density changed from 'low' to 'high', however, a quadratic response was also obtained with high TSMK resulting from 'medium' plant density. These resulted in linear and quadratic responses at OSLs of 8 and 6%, respectively (Tables 49 and 53). The cultivar x plant density interaction was also significant at an OSL of 8% in 1982 (Table 49). Florunner and Spanco yielded their highest %TSMK at 'medium' plant density while Pronto and Tamnut 74 produced their highest percentages at 'low' plant density (Table 53).

In the two years studied, Florunner produced more TSMK than the spanish cultivars in the long season of 1981. However, the reverse was true in the shorter growing season of 1982. Spanco had a consistently lower percentage of TSMK than its relative, Pronto. The comparatively low percentages of TSMK for Spanco observed at 'medium' and 'high' plant densities in the long growing season of 1981 suggest that Spanco may be more sensitive to mature pod loss than is Pronto at the higher plant densities. The inconsistent differences between Tamnut 74 and Pronto + Spanco in the two years could be partially explained by their differences in maturity and the seasonal variation.

Row spacing tended to have little effect on TSMK, however, with the highest %TSMK at 'intermediate' rows, the results suggest that 'intermediate' rows may be optimum for TSMK production. Similarly, 'medium' plant density may be optimum for TSMK production.

In this study, pod yield of peanut cultivars was partially influenced by growing season. The late maturing cultivar, Florunner, performed better in the long season of 1981. In contrast, the earlier maturing, spanish cultivars performed better in the shorter growing season of 1982. All cultivars had similar yield responses to row spacings and plant densities. Malagamba (1976) and Knauft et al. (1981) reported that yield response was independent of growth habit. Matlock (1961) and Lipscomb et al. (1965) also found that peanuts of different genotypes responded to row spacing and seeding rate similarly.

Pod yield of all cultivars tended to increase with decreased row spacing from 'wide' to 'intermediate' rows and stabilized or declined thereafter. There was no statistically significant difference in yield between 'narrow' and 'twin' rows, but slightly higher pod yield was consistently obtained from 'twin' rows. Duke and Alexander (1964) and Lipscomb et al. (1965) obtained significantly higher yields from 12-inch (30.5 cm) and 18-inch (45.7 cm) rows over 36-inch (91.4 cm) rows for bunch and spanish cultivars, but not for runner-type cultivars. Kirby et al. (1970) found that the yield of twin row was higher or equal to normal row pattern.

For plant density, all cultivars tended to produce higher yields with increased plant density from 'low' (2 plants/30.5 cm) to 'medium' level (4 plants/30.5 cm) and stabilized or declined thereafter. Matlock (1961) found that peanut yield in Oklahoma increased with increased seeding rate from 2.4 to 4.8 seeds/ft and then sharply declined when increased to 9.6 seeds/ft.

In the two years data, the highest yields were consistently produced at 'medium' plant density in 'intermediate' rows, at which the plant population was anticipated to be 215,273 plants/ha (Table 54). The results were in close agreement with those previously reported (Anonymous, 1934; Cox and Reid, 1965; Mixon, 1969). Mixon (1969) found that 18 x 3 inch (45.7 x 7.6 cm) (same as 'medium' plant density in 'intermediate' rows in this study) produced approximately 14% over 18 x 6 inch (45.7 x 15.2 cm) (same as 'low' plant density in 'intermediate' rows in this study). However, yield improvement comparing the previously mentioned spacings was 9.4% in this study.

TABLE 54

ANTICIPATED PLANT POPULATIONS AT VARIOUS SPATIAL ARRANGEMENTS

Row Spacing	Plant Density		
	Low	Medium	High
Wide	71,757[a/] (29,040)[b/]	143,515 (58,080)	215,273 (87,120)
Intermediate[c/]	107,636 (43,560)	215,273 (87,120)	322,910 (130,680)
Narrow[c/]	143,515 (58,080)	287,031 (116,160)	430,547 (174,240)
Twin	143,515 (58,080)	287,031 (116,160)	430,547 (174,240)

a/ Plants/Hectare.

b/ Plants/Acre.

c/ Please note that population number would need to be adjusted upwards for 'intermediate' and 'narrow' rows if rows had been planted behind the tire tracks of the tractor as detailed in the material and methods section.

In considering yield improvement in the peanut crop, it is important to consider row spacing, plant density, and plant population/unit area simultaneously since the adjustability of plant population for yield seem to be very high. Frequently, similar yields were obtained from a wide range of peanut plant populations, with different spatial arrangements (McClelland, 1931; Lutrick et al., 1961, 1962; Matlock, 1961; Meredith, 1964; Basinski et al., 1964; Kirby et al., 1970; Kvien et al., 1983). Malagamba (1976) found that yield response declined slowly starting at a population level of 20 to 22.5 plants/m^2 (200,000 to 225,000 plants/ha), while Azu and Tanner (1978) obtained the highest yields consistently from plant density at 11.34 and 25.51 plants/m^2 (113,400 and 255,100 plants/ha). Since the highest yields in this study were not obtained from any spatial arrangements or plant populations exceeding that of 'medium' plant density in 'intermediate' rows (215,273 plants/ha); the results were in good agreement with those reported by Malagamba (1976) and Azu and Tanner (1978), and implied that 'medium' plant density in 'intermediate' rows would probably be the optimum combination and appropriate spatial arrangement for yield under the conditions studied.

For grade factors, peanut cultivars produced significantly different grade factors in the two years. There was either no change or improvement in grade factors when row width was reduced from 'wide' to 'intermediate', and plant density was increased from 'low' to 'medium'. Further narrowing of the row spacing or further increasing the plant density resulted in no change in yield or produced detrimental effects in grade factors. The results were similar to those reported by Smartt (1964), Lipscomb et al. (1965), and Norden and Lipscomb (1974). Smartt (1964) found that seed quality was lower when planted at a population above the optimum for yield.

Economic Consideration

Analyses for cost and return were performed to determine if any of these treatment combinations are of practical value. Since cultivars have different seed weight which, in turn, resulted in different seed cost, economical analyses were performed separately for Florunner and the spanish cultivars. For seed cost calculation, 800 seeds/453.5 g and 1,200 seeds/453.5 g were used for Florunner and spanish cultivars, respectively, with both costing 65 cents/453.5 g (Tables 55 and 56). Peanut crop values were obtained by computing peanut yield and grade factors as given in the USDA Peanut Loan Schedule. The difference between the peanut crop value and the seed cost was designated as 'adjusted gross return'.

From Tables 57-59, Florunner gave the highest 'adjusted gross return' at 'medium' plant density in 'intermediate' rows in both years and, thus, also for the two-year average. The highest 'adjusted gross returns' for row spacings were obtained from 'intermediate' rows in 1981, 'wide' rows in 1982 and 'intermediate' rows for the two-year average.

For Pronto (Tables 60-62), the highest 'adjusted gross returns' were obtained at 'low' plant density in 'intermediate' rows in 1981 and for the two-year average, but at 'medium' plant density in 'intermediate' rows in 1982. The highest 'adjusted gross returns' for row spacings were obtained from 'intermediate' rows in both years.

Spanco (Tables 63-65) produced the highest 'adjusted gross returns' at 'low' plant density in 'intermediate' rows in 1981, at 'low' plant density in 'twin' rows in 1982 and for the two-year average. The highest 'adjusted gross returns' for row spacings were obtained from 'intermediate' rows in both years.

Tamnut 74 (Tables 66-68) produced consistently the highest 'adjusted gross returns' at 'medium' plant density in 'intermediate' rows, and the highest 'adjusted gross returns' for row spacings in 'intermediate' rows.

TABLE 55

SEED COST FOR FLORUNNER CULTIVAR

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	----------	$/ha	----------	
Wide	58.30[a]	116.60	174.90	116.60
Intermediate	87.45	174.90	262.36	174.90
Narrow	116.60	233.21	349.81	233.20
Twin	116.60	233.21	349.81	233.20

[a] Calculation based on anticipated plant population in Table 54, 800 seeds/453.5 g and 65 cents/453.5 g.

TABLE 56

SEED COST FOR SPANISH CULTIVARS

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	38.86[a]	77.73	116.60	77.73
Intermediate	58.30	116.60	174.90	116.60
Narrow	77.73	155.47	233.21	155.47
Twin	77.73	155.47	233.21	155.47

[a] Calculation based on anticipated plant population in Table 54, 1200 seeds/453.5 g and 65 cents/453.5 g.

TABLE 57

ADJUSTED GROSS RETURN FOR FLORUNNER AT VARIOUS SPATIAL ARRANGEMENTS, 1981

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1699[a]	1950	1729	1793
Intermediate	1834	2012	1771	1872
Narrow	1884	1764	1495	1714
Twin	1951	1770	1560	1760
Mean	1842	1874	1639	1785

[a] Values reported have had seed costs subtracted.

TABLE 58

ADJUSTED GROSS RETURN FOR FLORUNNER AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1269[a]	1658	1661	1529
Intermediate	1432	1704	1381	1506
Narrow	1438	1549	1278	1422
Twin	1665	1502	1278	1482
Mean	1451	1603	1399	1485

[a] Values reported have had seed costs subtracted.

TABLE 59

AVERAGE ADJUSTED GROSS RETURN FOR FLORUNNER AT VARIOUS SPATIAL ARRANGEMENTS, 1981 and 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1484[a]	1804	1695	1661
Intermediate	1633	1858	1576	1689
Narrow	1661	1657	1386	1568
Twin	1808	1636	1419	1621
Mean	1646	1739	1519	1635

[a] Values reported have had seed costs subtracted.

TABLE 60

ADJUSTED GROSS RETURN FOR PRONTO AT VARIOUS SPATIAL ARRANGEMENTS, 1981

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1377[a]	1586	1476	1479
Intermediate	1690	1484	1334	1503
Narrow	1341	1351	1102	1265
Twin	1421	1379	1075	1291
Mean	1457	1450	1247	1385

[a] Values reported have had seed costs subtracted.

TABLE 61

ADJUSTED GROSS RETURN FOR PRONTO AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1809[a]	1766	1826	1800
Intermediate	1888	2036	2034	1986
Narrow	1817	1928	2032	1925
Twin	1939	1949	1778	1889
Mean	1863	1920	1917	1900

[a] Values reported have had seed costs subtracted.

TABLE 62

AVERAGE ADJUSTED GROSS RETURN FOR PRONTO AT VARIOUS SPATIAL ARRANGEMENTS, 1981 and 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1593[a]	1676	1651	1640
Intermediate	1789	1760	1684	1744
Narrow	1579	1640	1567	1595
Twin	1680	1664	1426	1590
Mean	1660	1685	1582	1642

[a] Values reported have had seed costs subtracted.

TABLE 63

ADJUSTED GROSS RETURN FOR SPANCO AT VARIOUS SPATIAL ARRANGEMENTS, 1981

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1064[a]	1184	1057	1102
Intermediate	1211	1167	1038	1138
Narrow	1080	1061	1042	1061
Twin	1185	1187	901	1091
Mean	1135	1150	1009	1098

[a] Values reported have had seed costs subtracted.

TABLE 64

ADJUSTED GROSS RETURN FOR SPANCO AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1666[a]	2025	2113	1935
Intermediate	1924	2106	2032	2021
Narrow	1947	1910	1737	1865
Twin	2257	1999	1631	1962
Mean	1948	2010	1878	1946

[a] Values reported have had seed costs subtracted.

TABLE 65

AVERAGE ADJUSTED GROSS RETURN FOR SPANCO AT VARIOUS SPATIAL ARRANGEMENTS, 1981 and 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1365[a]	1604	1585	1518
Intermediate	1567	1636	1535	1579
Narrow	1513	1486	1390	1463
Twin	1721	1593	1266	1527
Mean	1541	1580	1444	1522

[a] Values reported have had seed costs subtracted.

TABLE 66

ADJUSTED GROSS RETURN FOR TAMNUT 74 AT VARIOUS SPATIAL ARRANGEMENTS, 1981

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1516[a]	1634	1420	1523
Intermediate	1719	1722	1526	1655
Narrow	1476	1247	1275	1333
Twin	1498	1350	1356	1401
Mean	1552	1488	1394	1478

[a] Values reported have had seed costs subtracted.

TABLE 67

ADJUSTED GROSS RETURN FOR TAMNUT 74 AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1872[a]	1991	1983	1949
Intermediate	1932	2052	1952	1979
Narrow	1857	1841	1904	1868
Twin	2022	1976	1814	1937
Mean	1921	1965	1913	1933

[a] Values reported have had seed costs subtracted.

TABLE 68

AVERAGE ADJUSTED GROSS RETURN FOR TAMNUT 74 AT VARIOUS SPATIAL ARRANGEMENTS, 1981 and 1982

Row Spacing	Plant Density			Mean
	Low	Medium	High	
	$/ha			
Wide	1694[a]	1812	1701	1736
Intermediate	1825	1887	1739	1817
Narrow	1666	1544	1590	1600
Twin	1760	1663	1585	1669
Mean	1736	1726	1654	1705

[a] Values reported have had seed costs subtracted.

From the above analyses, the highest 'adjusted gross return' was obtained at 'medium' plant density in 'intermediate' rows for Florunner, Pronto, and Tamnut 74. However, the highest 'adjusted gross return' for Spanco was obtained from 'low' plant density in either 'intermediate' or 'twin' rows.

In current practice, cultivation of the peanut crop in Oklahoma is made with plant density ranging from 'low' to 'high' (2 to 6 seeds/30.5 cm) in 'wide' rows (Kirby, 1980, Personal communication). From the data herein, it is more likely that cultivating these peanut cultivars with plant density ranging from 'low' to 'medium' (2 to 4 seeds/30.5 cm) in intermediate row spacings (45.7 cm apart) with resulting plant populations of 107,636 to 215,273 plants/ha will provide more profit to peanut growers under Oklahoma production conditions.

CHAPTER V

SUMMARY AND CONCLUSIONS

Peanut or groundnut (*Arachis hypogaea* L.) is a major cash crop in the United States. Cultivation has been practiced for forage, food, feed, and oil. Yield improvement can be made by expansion of cultivated area, by increasing yield/unit area, or both. Practically, an increase in yield/unit area is more efficient and interesting than an increase in the area of production because arable land is becoming progressively more limited. One of many possibilities for improving yield/unit area is the growing of adapted cultivars at optimum plant populations and with suitable plant arrangements.

Results from various reports indicated that considerable yield increase and grade factor improvement can be obtained by either narrowing row spacing or increasing plant density to certain levels. It was thus the objective of this study to investigate if yield and quality of peanut cultivars grown under irrigation in Oklahoma can be improved by changing row spacing and within-row plant density, to determine the optimum plant population(s) with appropriate spatial arrangement(s), as well as to compare the yielding potential of four peanut cultivars available for production in Oklahoma.

The research was conducted at the Caddo Peanut Research Station in 1981 and 1982. The four replication split-plot design experiment utilized the four peanut cultivars (Florunner, Pronto, Spanco, and Tamnut 74) as the main plot factors and the four row spacings and three within-row plant densities as sub-plot factors.

The results indicated that yield responses of these cultivars were independent of growth habit. Pod yield was generally improved when row spacing was narrowed from 'wide' row spacing (91.4 cm) to an 'intermediate' row spacing (45.7 cm). Pod yield also improved when within-row plant density was increased from 'low' plant density (2 plants/30.5 cm) to 'medium' plant density (4 plants/30.5 cm). Further narrowing of row spacing as well as further increasing within-row plant density either resulted in no yield improvement or in detrimental effects to yield and grade factors. The appropriate spatial arrangement for these four cultivars was 45.7 cm between rows and 4 plants/30.5 cm within the row at which plant population was anticipated to be 215,273 plants/ha. Cultivar performance varied in the two years studied. Florunner performed better in the long season of 1981 while Pronto, Spanco, and Tamnut 74 performed better in the shorter season of 1982.

Results from simple economical analysis indicated that a monetary advantage over present practices in Oklahoma can be obtained by growing the peanut cultivars in 'intermediate' rows (45.7 cm) at 4 plants/30.5 cm.

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APPENDIX

TABLE 69

MEAN VALUES FOR CHARACTERS OF CULTIVARS, ROW SPACINGS, AND PLANT DENSITIES, 1981

Source	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
	kg/ha	g	%					$/ha
Florunner	3494	60.52	2.50	2.67	8.47	65.24	73.71	1785
Pronto	2743	46.81	1.95	1.66	10.25	60.70	70.95	1385
Spanco	2445	41.95	3.78	2.03	8.80	55.48	64.28	1098
Tamnut 74	2967	43.37	2.07	2.00	12.26	57.84	70.11	1478
Wide	2904	48.01	2.61	2.24	10.51	58.94	69.45	1474
Intermediate	3092	48.08	2.46	2.09	9.36	60.27	69.64	1542
Narrow	2791	48.33	2.60	2.08	9.45	60.32	69.77	1343
Twin	2863	48.22	2.63	1.96	10.47	59.73	70.21	1386
2 Plants	2884	48.01	2.57	2.18	10.60	59.40	70.00	1497
4 Plants	3031	48.04	2.62	2.15	9.65	59.83	69.48	1491
6 Plants	2822	48.43	2.52	1.94	9.60	60.21	69.82	1322
Mean	2912	48.16	2.57	2.09	9.95	59.81	69.77	1437
C.V. %	10.47	5.06	54.90	64.65	41.21	8.66	5.91	----

TABLE 70

MEAN VALUES FOR CHARACTERS OF CULTIVARS AT VARIOUS ROW SPACINGS, 1981

Cultivar	Row Spacing	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
		kg/ha	g	-------------	-------------	%	-------------	-------------	$/ha
Florunner	Wide	3467	60.33	2.43	3.45	7.57	65.05	72.62	1793
"	Intermediate	3659	60.05	2.40	3.08	8.62	64.39	73.02	1872
"	Narrow	3343	61.78	2.30	1.85	8.02	67.24	75.27	1714
"	Twin	3507	59.91	2.87	2.30	9.67	64.29	73.69	1760
	Mean	3494	60.52	2.50	2.67	8.47	65.24	73.71	1785
Pronto	Wide	2835	47.44	1.91	1.60	11.76	59.06	70.82	1479
"	Intermediate	2897	46.72	1.77	1.49	7.82	64.01	71.83	1503
"	Narrow	2603	46.90	2.50	1.95	10.56	59.75	70.82	1265
"	Twin	2637	46.19	1.62	1.60	10.87	59.97	70.85	1291
	Mean	2743	46.81	1.95	1.66	10.25	60.70	70.95	1385
Spanco	Wide	2400	40.80	4.07	2.16	9.58	53.60	63.19	1102
"	Intermediate	2541	41.99	4.31	1.77	8.18	55.02	63.21	1138
"	Narrow	2422	41.90	3.27	2.35	7.60	56.89	64.49	1061
"	Twin	2417	43.11	3.46	1.85	9.86	56.41	66.27	1091
	Mean	2445	41.95	3.78	2.03	8.80	55.48	64.29	1098
Tamnut 74	Wide	2914	43.50	2.03	1.76	13.12	58.06	71.19	1523
"	Intermediate	3269	43.57	1.35	2.01	12.83	57.65	70.49	1655
"	Narrow	2795	42.74	2.33	2.15	11.61	57.39	69.00	1333
"	Twin	2891	43.66	2.57	2.08	11.50	58.25	69.75	1401
	Mean	2967	43.37	2.07	2.00	12.26	57.84	70.11	1478

TABLE 71

MEAN VALUES FOR CHARACTERS OF CULTIVARS AT VARIOUS PLANT DENSITIES, 1981

Cultivar	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
		kg/ha	g	%					$/ha
Florunner	2 plants	3435	59.91	2.86	2.78	8.27	65.00	73.27	1842
"	4 plants	3731	60.38	2.63	3.15	8.23	64.39	72.62	1874
"	6 plants	3316	61.26	2.01	2.08	8.91	66.34	75.25	1639
	Mean	3494	60.52	2.50	2.67	8.47	65.24	73.71	1785
Pronto	2 plants	2787	47.00	1.86	1.69	11.74	58.65	70.39	1457
"	4 plants	2778	46.78	1.86	1.40	9.44	63.54	72.98	1450
"	6 plants	2664	46.66	2.13	1.89	9.59	59.90	69.50	1247
	Mean	2743	46.81	1.95	1.66	10.25	60.70	70.95	1385
Spanco	2 plants	2342	41.47	3.63	1.93	10.60	55.08	65.68	1135
"	4 plants	2575	42.09	3.66	2.03	8.17	55.42	63.60	1150
"	6 plants	2418	42.29	4.05	2.13	7.65	55.93	63.59	1009
	Mean	2445	41.95	3.78	2.03	8.80	55.48	64.29	1098
Tamnut 74	2 plants	2973	43.68	1.94	2.32	11.78	58.86	70.65	1552
"	4 plants	3041	42.90	2.35	2.03	12.75	55.98	68.73	1488
"	6 plants	2888	43.52	1.92	1.65	12.27	58.67	70.95	1394
	Mean	2967	43.37	2.07	2.00	12.26	57.84	70.11	1478

TABLE 72

MEAN VALUES FOR CHARACTERS AT VARIOUS SPATIAL ARRANGEMENTS, 1981

Row Spacing	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
		kg/ha	g	----------	----------	%	----------	----------	$/ha
Wide	2 plants	2710	47.69	2.77	2.25	10.32	58.74	69.06	1414
"	4 plants	3121	47.93	2.25	2.50	10.94	59.30	70.25	1588
"	6 plants	2880	48.42	2.81	1.98	10.26	58.79	69.06	1420
	Mean	2904	48.01	2.61	2.24	10.51	58.94	69.45	1474
Intermediate	2 plants	3087	47.80	2.24	2.42	9.35	60.82	70.17	1614
"	4 plants	3236	48.20	2.26	2.27	8.28	60.41	68.70	1596
"	6 plants	2952	48.25	2.87	1.57	10.47	59.57	70.04	1417
	Mean	3092	48.08	2.46	2.09	9.36	60.27	69.64	1542
Narrow	2 plants	2804	48.96	2.19	2.09	11.02	59.24	70.26	1445
"	4 plants	2837	47.68	3.26	1.91	8.98	59.91	68.89	1356
"	6 plants	2732	48.35	2.34	2.24	8.35	61.80	70.15	1229
	Mean	2791	48.33	2.60	2.08	9.45	60.32	69.70	1343
Twin	2 plants	2935	47.61	3.09	1.97	11.70	58.79	70.50	1514
"	4 plants	2931	48.34	2.72	1.93	10.38	59.70	70.09	1422
"	6 plants	2723	48.71	2.08	1.97	9.33	60.69	70.03	1223
	Mean	2863	48.22	2.63	1.96	10.47	59.73	70.21	1386

TABLE 73

MEAN VALUES FOR CHARACTERS OF CULTIVARS AT VARIOUS SPATIAL ARRANGEMENTS, 1981

Cultivar	Row Spacing	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
			kg/ha	g	%					$/ha
Florunner	Wide	2 plants	3117	59.87	3.00	2.70	7.60	65.33	72.93	1699
		4 plants	3998	59.72	2.55	5.37	7.21	62.55	69.76	1950
		6 plants	3286	61.40	1.75	2.28	7.91	67.26	75.17	1729
"	Intermediate	2 plants	3422	59.75	2.40	3.78	7.36	65.85	73.21	1834
		4 plants	4015	59.87	2.53	3.26	7.50	63.52	71.02	2012
		6 plants	3540	60.52	2.28	2.20	11.01	63.81	74.82	1771
"	Narrow	2 plants	3371	62.17	2.22	1.57	7.35	69.12	76.47	1884
		4 plants	3473	60.42	2.35	2.25	8.25	66.37	74.62	1764
		6 plants	3185	62.75	2.32	1.73	8.47	66.23	74.71	1495
"	Twin	2 plants	3828	57.87	3.83	3.06	10.78	59.70	70.48	1951
		4 plants	3439	61.50	3.08	1.75	9.97	65.12	75.10	1770
		6 plants	3252	60.37	1.68	2.10	8.25	68.05	76.30	1560
	Mean		3494	60.52	2.50	2.67	8.47	65.24	73.71	1785
Pronto	Wide	2 plants	2677	48.05	1.91	1.88	14.98	53.58	68.57	1377
		4 plants	2880	47.60	1.33	1.40	10.31	64.20	74.51	1586
		6 plants	2948	46.67	2.50	1.52	9.98	59.41	69.40	1476
"	Intermediate	2 plants	3185	45.07	1.82	1.38	7.76	62.67	70.43	1690
		4 plants	2795	47.05	1.67	1.75	6.71	66.70	73.41	1484
		6 plants	2710	48.05	1.82	1.35	9.00	62.66	71.66	1334
"	Narrow	2 plants	2592	48.50	2.01	1.80	14.91	56.03	70.95	1341
		4 plants	2727	46.47	3.03	1.75	9.00	61.87	70.87	1351
		6 plants	2490	45.75	2.45	2.32	7.78	61.35	69.13	1102

TABLE 73 (Continued)

Cultivar	Row Spacing	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
			kg/ha	g	%					$/ha
Pronto	Twin	2 plants	2693	46.37	1.72	1.71	9.30	62.31	70.61	1421
		4 plants	2710	46.02	1.40	0.73	11.73	61.40	73.13	1379
		6 plants	2507	46.17	1.75	2.37	11.58	56.21	67.80	1075
	Mean		2743	46.81	1.95	1.66	10.25	60.70	70.95	1385
Spanco	Wide	2 plants	2202	38.72	4.55	1.91	10.57	53.50	64.07	1064
		4 plants	2541	40.92	3.36	2.11	10.20	53.98	64.18	1184
		6 plants	2456	42.75	4.32	2.46	7.98	53.32	61.31	1057
"	Intermediate	2 plants	2456	43.15	3.60	2.21	9.80	56.81	66.61	1211
		4 plants	2710	42.40	3.58	1.52	5.82	54.45	60.27	1167
		6 plants	2456	40.42	5.76	1.60	8.93	53.81	62.75	1038
"	Narrow	2 plants	2287	42.02	2.43	1.88	8.78	56.15	64.93	1080
		4 plants	2456	41.15	4.65	1.82	7.46	55.60	63.06	1061
		6 plants	2524	42.55	2.72	3.35	6.55	58.92	65.47	1042
"	Twin	2 plants	2422	42.00	3.93	1.72	13.23	53.87	67.11	1185
		4 plants	2592	43.90	3.06	2.68	9.21	57.67	66.88	1187
		6 plants	2236	43.45	3.38	1.13	7.13	57.68	64.82	901
	Mean		2445	41.95	3.78	2.03	8.80	55.48	64.29	1098

TABLE 73 (Continued)

Cultivar	Row Spacing	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
			kg/ha	g	%					$/ha
Tamnut 74	Wide	2 plants	2846	44.12	1.65	2.50	8.12	62.53	70.66	1516
		4 plants	3066	43.50	1.78	1.15	16.06	56.48	72.55	1634
		6 plants	2829	42.87	2.67	1.65	15.18	55.17	70.36	1420
"	Intermediate	2 plants	3286	43.22	1.16	2.32	12.47	57.97	70.45	1719
		4 plants	3422	43.50	1.27	2.57	13.10	56.98	70.08	1722
		6 plants	3100	44.00	1.63	1.13	12.93	58.00	70.93	1526
"	Narrow	2 plants	2965	43.17	2.11	3.10	13.03	55.67	68.71	1476
		4 plants	2693	42.67	3.02	1.82	11.21	55.81	67.02	1247
		6 plants	2727	42.37	1.86	1.55	10.58	60.70	71.28	1275
"	Twin	2 plants	2795	44.20	2.86	1.38	13.50	59.28	72.78	1498
		4 plants	2981	41.95	3.33	2.57	10.62	54.63	65.26	1350
		6 plants	2897	44.85	1.51	2.28	10.37	60.83	71.21	1356
	Mean		2967	43.37	2.07	2.00	12.26	57.84	70.11	1478

TABLE 74

MEAN VALUES FOR CHARACTERS OF CULTIVARS, ROW SPACINGS, AND PLANT DENSITIES, 1982

Source	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
	kg/ha	g	%					$/ha
Florunner	3360	54.99	8.07	0.10	1.20	61.55	62.75	1485
Pronto	3567	47.63	1.07	0.27	4.63	68.13	72.76	1900
Spanco	3827	47.86	1.54	0.21	5.00	64.25	69.25	1946
Tamnut 74	3804	42.33	1.92	0.34	5.47	63.84	69.31	1933
Wide	3501	48.78	3.01	0.14	4.38	64.50	68.88	1803
Intermediate	3684	48.69	2.69	0.21	3.94	65.36	69.30	1873
Narrow	3648	47.58	3.61	0.21	4.08	63.70	67.78	1770
Twin	3725	47.76	3.28	0.36	3.90	64.21	68.11	1818
2 plants	3460	47.87	3.24	0.21	4.44	64.28	68.72	1796
4 plants	3719	48.73	2.81	0.24	4.06	65.11	69.18	1875
6 plants	3740	48.00	3.40	0.23	3.72	63.93	67.66	1777
Mean	3640	48.20	3.15	0.23	4.07	64.44	68.52	1816
C.V. %	10.77	5.40	54.32	203.42	34.21	5.12	4.93	----

TABLE 75

MEAN VALUES FOR CHARACTERS OF CULTIVARS AT VARIOUS ROW SPACINGS, 1982

Cultivar	Row Spacing	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
		kg/ha	g	%					$/ha
Florunner	Wide	3298	55.44	8.29	0.00	1.01	61.61	62.62	1529
"	Intermediate	3326	55.76	7.64	0.04	1.27	62.50	63.77	1506
"	Narrow	3315	54.60	7.98	0.07	1.32	61.62	62.95	1422
"	Twin	3501	54.16	8.38	0.30	1.19	60.47	61.66	1482
	Mean	3360	54.99	8.07	0.10	1.20	61.55	62.75	1485
Pronto	Wide	3269	48.19	1.09	0.23	4.67	68.91	73.59	1800
"	Intermediate	3716	47.38	0.99	0.34	4.28	68.22	72.50	1986
"	Narrow	3699	47.70	1.40	0.34	5.05	66.83	71.89	1925
"	Twin	3586	47.25	0.79	0.16	4.53	68.55	73.08	1889
	Mean	3567	47.63	1.07	0.27	4.63	68.13	72.76	1900
Spanco	Wide	3704	48.87	1.32	0.19	6.12	63.60	69.72	1935
"	Intermediate	3851	47.97	0.94	0.20	4.71	66.34	71.05	2021
"	Narrow	3795	46.81	1.73	0.25	4.75	63.25	68.01	1865
"	Twin	3958	47.79	2.17	0.23	4.42	63.80	68.22	1962
	Mean	3827	47.86	1.54	0.21	5.00	64.25	69.25	1946
Tamnut 74	Wide	3732	42.64	1.35	0.14	5.72	63.87	69.60	1949
"	Intermediate	3845	43.66	1.19	0.27	5.49	64.38	69.87	1979
"	Narrow	3783	41.20	3.34	0.17	5.20	63.08	68.29	1868
"	Twin	3857	41.84	1.80	0.77	5.45	64.01	69.46	1937
	Mean	3804	42.33	1.92	0.34	5.47	63.84	69.31	1933

TABLE 76

MEAN VALUES FOR CHARACTERS OF CULTIVARS AT VARIOUS PLANT DENSITIES, 1982

Cultivar	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
		kg/ha	g	%					$/ha
Florunner	2 plants	3134	54.47	8.86	0.03	1.14	60.79	61.94	1451
"	4 plants	3481	55.83	6.78	0.22	1.37	63.83	65.20	1603
"	6 plants	3464	54.67	8.58	0.05	1.08	60.03	61.11	1399
	Mean	3360	54.99	8.07	0.10	1.20	61.55	62.75	1485
Pronto	2 plants	3380	47.02	1.13	0.15	5.17	67.90	73.07	1863
"	4 plants	3621	47.74	1.07	0.27	4.62	67.80	72.42	1920
"	6 plants	3701	48.13	1.00	0.38	4.11	68.69	72.80	1917
	Mean	3567	47.63	1.07	0.27	4.63	68.13	72.76	1900
Spanco	2 plants	3714	47.80	1.69	0.14	5.17	64.19	69.36	1948
"	4 plants	3926	48.31	1.08	0.28	5.00	64.68	69.68	2010
"	6 plants	3841	47.47	1.85	0.23	4.83	63.88	68.72	1878
	Mean	3827	47.86	1.54	0.21	5.00	64.25	69.25	1946
Tamnut 74	2 plants	3612	42.20	1.28	0.55	6.27	64.23	70.50	1921
"	4 plants	3850	43.05	2.33	0.21	5.25	64.14	69.40	1965
"	6 plants	3951	41.75	2.16	0.25	4.88	63.14	68.02	1913
	Mean	3804	42.33	1.92	0.34	5.47	63.84	69.31	1933

TABLE 77

MEAN VALUES FOR CHARACTERS AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Row Spacing	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
		kg/ha	g	%					$/ha
Wide	2 plants	3142	48.02	3.49	0.10	4.36	64.24	68.60	1654
"	4 plants	3600	48.84	2.67	0.16	4.74	64.46	69.20	1860
"	6 plants	3761	49.49	2.88	0.16	4.05	64.80	68.86	1896
	Mean	3501	48.78	3.01	0.14	4.38	64.50	68.88	1803
Intermediate	2 plants	3401	47.76	2.54	0.25	4.15	65.53	69.69	1794
"	4 plants	3867	49.28	2.51	0.16	3.83	65.69	69.52	1975
"	6 plants	3786	49.04	3.02	0.24	3.83	64.86	68.70	1875
	Mean	3684	48.69	2.69	0.21	3.94	65.36	69.30	1881
Narrow	2 plants	3456	48.30	3.50	0.04	4.82	63.44	68.27	1765
"	4 plants	3672	47.86	3.26	0.32	4.03	64.74	68.77	1807
"	6 plants	3816	46.56	4.07	0.26	3.40	62.91	66.31	1738
	Mean	3648	47.58	3.61	0.21	4.08	63.70	67.78	1770
Twin	2 plants	3841	47.40	3.43	0.48	4.41	63.90	68.32	1971
"	4 plants	3740	48.95	2.81	0.35	3.65	65.56	69.22	1857
"	6 plants	3596	46.93	3.61	0.26	3.62	63.17	66.79	1625
	Mean	3725	47.76	3.28	0.36	3.90	64.21	68.11	1818

TABLE 78

MEAN VALUES FOR CHARACTERS OF CULTIVARS AT VARIOUS SPATIAL ARRANGEMENTS, 1982

Cultivar	Row Spacing	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
			kg/ha	g	%					$/ha
Florunner	Wide	2 plants	2829	53.20	10.81	0.00	0.96	57.60	58.56	1269
		4 plants	3490	55.85	7.20	0.00	0.87	63.42	64.30	1658
		6 plants	3574	57.27	6.86	0.00	1.20	63.82	65.02	1661
"	Intermediate	2 plants	2998	55.52	7.60	0.00	0.81	63.18	64.00	1432
		4 plants	3574	56.37	5.97	0.00	1.71	65.03	66.75	1704
		6 plants	3405	55.40	9.35	0.13	1.28	59.28	60.57	1381
"	Narrow	2 plants	3134	55.47	8.53	0.00	1.41	61.03	62.45	1438
		4 plants	3405	56.10	5.68	0.11	1.63	64.85	66.48	1549
		6 plants	3405	52.22	9.73	0.10	0.91	59.00	59.91	1278
"	Twin	2 plants	3574	53.70	8.51	0.12	1.40	61.36	62.76	1665
		4 plants	3456	55.00	8.26	0.77	1.26	62.02	63.28	1502
		6 plants	3473	53.80	8.37	0.00	0.92	58.02	58.95	1278
	Mean		3360	54.99	8.07	0.10	1.20	61.55	62.75	1485
Pronto	Wide	2 plants	3168	48.15	0.56	0.15	4.83	69.93	74.77	1809
		4 plants	3236	47.07	1.36	0.30	5.32	67.68	73.01	1766
		6 plants	3405	49.35	1.36	0.25	3.87	69.11	72.98	1826
"	Intermediate	2 plants	3422	45.90	0.81	0.20	5.37	67.61	72.98	1888
		4 plants	3845	47.75	1.17	0.27	3.58	68.06	71.65	2036
		6 plants	3879	48.50	1.00	0.55	3.88	69.00	72.88	2034
"	Narrow	2 plants	3388	47.60	1.95	0.02	6.03	65.58	71.62	1817
		4 plants	3693	47.87	1.20	0.40	4.12	68.07	72.20	1928
		6 plants	4042	47.65	1.06	0.58	5.00	66.85	71.85	2032

TABLE 78 (Continued)

Cultivar	Row Spacing	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
			kg/ha	g	%					$/ha
Pronto	Twin	2 plants	3540	46.45	1.22	0.22	4.43	68.46	72.90	1939
		4 plants	3710	48.27	0.55	0.11	5.47	67.37	72.85	1949
		6 plants	3507	47.02	0.60	0.16	3.68	69.82	73.51	1778
	Mean		3567	47.63	1.07	0.27	4.63	68.13	72.76	1900
Spanco	Wide	2 plants	3100	48.37	1.51	0.11	6.30	64.22	70.52	1666
		4 plants	3896	49.67	1.15	0.22	6.81	62.45	69.26	2025
		6 plants	4116	48.57	1.32	0.23	5.27	64.12	69.40	2113
"	Intermediate	2 plants	3574	48.00	0.83	0.41	4.96	66.05	71.01	1924
		4 plants	4049	47.90	0.83	0.05	4.41	65.88	70.30	2106
		6 plants	3930	48.02	1.16	0.15	4.76	67.10	71.86	2032
"	Narrow	2 plants	3812	47.75	2.11	0.00	4.76	63.02	67.78	1947
		4 plants	3828	46.10	1.13	0.52	4.88	64.16	69.05	1910
		6 plants	3744	46.60	1.95	0.22	4.62	62.58	67.21	1737
"	Twin	2 plants	4371	47.07	2.30	0.05	4.67	63.47	68.15	2257
		4 plants	3930	49.60	1.22	0.32	3.90	66.22	70.12	1999
		6 plants	3574	46.70	2.98	0.32	4.68	61.72	66.41	1631
	Mean		3827	47.86	1.54	0.21	5.00	64.25	69.25	1946
Tamnut 74	Wide	2 plants	3473	42.37	1.08	0.13	5.35	65.20	70.55	1872
		4 plants	3778	42.77	1.00	0.12	5.95	64.28	70.23	1991
		6 plants	3947	42.77	1.97	0.17	5.88	62.15	68.03	1983

TABLE 78 (Continued)

Cultivar	Row Spacing	Plant Density/ 30.5 cm	Yield	100 Seed Weight	Other Kernels	Damaged Kernels	Sound Splits	Sound Mature Kernels	Total Sound Mature Kernels	Adjusted Gross Returns
			kg/ha	g			%			$/ha
Tamnut 74	Intermediate	2 plants	3608	41.65	0.91	0.38	5.48	65.28	70.77	1932
		4 plants	3998	45.10	2.07	0.32	5.61	63.77	69.38	2052
		6 plants	3930	44.25	0.60	0.12	5.38	64.08	69.47	1952
"	Narrow	2 plants	3490	42.40	1.43	0.13	7.08	64.13	71.22	1857
		4 plants	3761	41.40	5.03	0.23	5.47	61.90	67.37	1841
		6 plants	4099	39.80	3.56	0.16	3.06	63.21	66.27	1904
"	Twin	2 plants	3879	42.40	1.70	1.55	7.16	62.31	69.47	2022
		4 plants	3862	42.92	1.21	0.18	4.00	66.62	70.62	1976
		6 plants	3828	40.20	2.51	0.57	5.18	63.11	68.30	1814
	Mean		3804	42.33	1.92	0.34	5.47	63.84	69.31	1933

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