# Intrarow Seed Spacing Effects on Morphological Characteristics, Yield, Grade and Net Value of Five Peanut Cultivars[1]

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**ABSTRACT**

Peanut (*Arachis hypogaea* L.) producers in the Virginia-Carolina production area have not adopted row spacings closer than the conventional 91.4 cm. Seeding rates at this row width must be adequate, but not excessive, to maximize net value. With the recent development of new cultivars with different growth habits, this study was conducted to determine the effect of intrarow seed spacing on morphological characteristics, yield, grade, gross value, and net value for five cultivars currently available to growers. The cultivars Florigiant, NC 6, NC 7, Virginia 81 Bunch (VA 81B), and NC 9 were seeded at intrarow spacings of 5.1, 7.6, 10.2, and 15.2 cm in a 3-year field study at the Tidewater Agricultural Experiment Station, Suffolk, Virginia, from 1984 to 1986. Plots consisted of two rows 3.0 m long with interrow spacing of 91.4 cm for all treatments. A split plot design with five replications was used. Generally, main stems were taller and cotyledonary lateral branches were longer with closer intrarow seed spacings. The number of pods/plant decreased and number of pods/m of row increased with closer intrarow spacings. Seed spacings had little effect on the grade characteristics of the five cultivars, except that NC 6 had the greatest percentages of sound mature kernels and total meat at the 10.2-cm spacing, while Florigiant had the greatest percentage of total meat at the 15.2-cm spacing. For the spacings studies, pod yield increased with closer intrarow seed spacings. All cultivars had significantly greater yields at the 5.1-cm spacing than the 15.2-cm spacing. Net value (gross value minus seed cost) was not significantly different among intrarow seed spacings for four of the five cultivars studied. The exception was VA 81B which had a significantly greater net value at 5.1- and 7.6-cm seed spacings than at wider spacings. This study showed that yields generally increase with closer intrarow seed spacing; however, net value may not increase.

Key Words: groundnut, seeding rate, market grade factors, net value

The large-seeded virginia-type peanut is traditionally planted in rows 91.4 cm wide with typical intrarow seed spacings of 7.6 cm for the Virginia-Carolina production area. Many producers prefer closer seed spacing to insure an adequate stand without replanting, and others prefer more peanut plants to gain better weed control through competition.

Higher seeding rates through closer intrarow spacings or decreased row widths generally produce greater yields. Roy *et al.* (12) showed that seeding rates between 180,000 and 300,000 plants/ha produced greater pod yields than lower or higher populations. Cox and Reid (3), using row widths of 91.4, 61.0, 45.7, and 30.5 cm with NC 2 found that increasing the plant population by decreasing row width generally increased yields. Buchanan and Hauser (1), using row spacings of 81.2, 40.6, and 20.3 cm with Florunner at constant seed spacings, also reported yield increases with decreased row width. Duke and Alexander (4) reported no significant yield increase with the runner growth habit peanut with a

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row spacing of 45.7 cm for three rows or 30.5 cm for four rows compared to the conventional 91.4-cm row spacing. However, for the bunch growth habit peanut, significantly greater yields were reported for the closer row spacings in 2 of the 3 years. Norden and Lipscomb (11), using a constant seeding rate in conventional 91.4-cm rows with a 7.6-cm seed spacing and narrow 46-cm rows with a 15.2-cm seed spacing, reported 16% greater yields for peanut lines with a bunch growth habit and only 5% for those with a runner growth habit in the narrower rows.

Mozingo and Coffelt (9), in a 4-year study of row pattern and seeding rate, reported the greatest yield with the bunch growth habit cultivar VA 81B at a high seeding rate (215,274 seed/ha in twin rows 17.8 cm apart centered in a 91.4 cm distance with intrarow seed spacing of 15.2 cm). Single rows spaced 91.4 cm with intrarow seeding of 7.6 and 15.2 cm tended to yield less than equal seeding rates on twin rows. Mixon (8) did not find a yield increase from row spacings closer than 91.4 cm or intrarow seed spacings closer than 15.2 cm for Early Runner, VA Bunch 67, and VA Runner G26. Wynne *et al.* (13) also reported no significant yield difference with row spacings less than 91.4 cm. However, the NC 17 and NC 5 cultivars had greater yields at the 12.7- than at 25.4-cm intrarow seed spacing. In a 6-year study Knauft *et al.* (5) reported that three genotypes (Dixie Runner, UF439-16-6-3, and UF714021) compensated for seed spacing by producing yields that were not different at intrarow spacings of 10.2, 15.2 and 30.5 cm when planted in rows 91.4 cm apart. Yields of Florunner and Florigiant were reduced with an intrarow seed spacing of 30.5 cm compared to 10.2- and 15.2- cm spacings. Early Bunch had reduced yields at 30.5-cm spacing compared to 15.2 cm, but yields at the 10.2- cm spacing were not significantly different from either the 30.5- or 15.2-cm spacing.

Minton and Csinos (7) used Florunner in a 2-year study of the effect of row spacing and seeding rate on nematodes and incidence of southern stem rot. Yield differences as affected by row spacing-seeding rate were not reported except in one test where single rows with seed spacing of 7.6 cm yielded more than twin rows with seed spacing of 7.6 cm. However, this yield increase was attributed to a greater incidence of southern stem rot in the twin row treatment.

Lipscomb *et al.* (6) showed an increase in pod yield with closer intrarow spacing for Dixie Spanish, but did not find differences for Early Runner. Both cultivars produced more vegetative growth with closer row spacings. Cahaner and Ashri (2) found that increasing the plant density of four virginia-type cultivars did not increase mature pod yield but did increase vegetative growth. In their study, cotyledonary branch length was not affected by plant density.

Differences in pod or seed size were not found among the intrarow seed spacings for any of the six genotypes studied by Knauft *et al.* (5). Wynne *et al.* (13) reported a significant increase in the percentages of extra large kernels (ELK) and sound mature kernels (SMK) for NC 17 at closer intrarow spacings. A decrease in fancy pod (FP) percentage at closer intrarow spacing was also reported for NC 5. Differences in market grade factors at intrarow spacings of 7.6, 11.4 and 15.2 cm over several row widths were not found by Mixon (8).

Since producers in the Virginia-Carolina area generally use 91.4-cm interrow spacing and new cultivars with different growth habits have been developed recently, this study was conducted to determine the effect of intrarow seed spacing on the morphological characteristics, yield, grade, gross value, and net value for five cultivars which are presently available to producers.

## Materials and Methods

Non-irrigated field tests were conducted at the Tidewater Agricultural Experiment Station in Suffolk, Virginia in 1984, 1985, and 1986. The soil type was an Eunola loamy fine sand (Aquic Hapludult) with similiar soil test analyses and planting and digging dates each year (Table 1). Cultivars were Florigiant, NC 6, NC 7, VA 81B, and NC 9. All were large-seeded virginia-type with various growth habits and slight differences in maturity (Table 2). However, digging date each year was within the maturity range of each cultivar. Other characteristics of these cultivars have been described by Mozingo *et al.* (10). The experimental design was a split plot with cultivars the whole plots and seed spacings the subplots. Plots were two rows 91.4-cm wide and 3.0-m long. Five replications were used.

**Table 1. Soil type and analyses, dates planted and dug, and number of growing days (1984 to 1986).**

| Year | Soil Type | ph | PPM P | PPM K | PPM Ca | PPM Mg | % OM | Date Planted | Date Dug | Days After Planting |
|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | Eunola loamy fine sand | 6.4 | 26 | 58 | 384 | 61 | 1.9 | May 11 | Oct. 2 | 144 |
| 1985 | Eunola loamy fine sand | 6.4 | 27 | 40 | 312 | 39 | 1.2 | May 8 | Oct. 2 | 147 |
| 1986 | Eunola loamy fine sand | 6.4 | 21 | 53 | 420 | 62 | 1.5 | May 13 | Oct. 2 | 142 |

**Table 2. Growth habit and maturity of five peanut cultivars.**

| Cultivar | Growth habit | Maturity (Days) |
|---|---|---|
| Florigiant | runner (spreading) | medium (145-155) |
| NC 6 | intermediate | early-medium (140-150) |
| NC 7 | intermediate | early-medium (140-150) |
| VA 81B | bunch (erect) | early (135-145) |
| NC 9 | runner (spreading) | early-medium (140-150) |

Intrarow seed spacings were 5.1, 7.6, 10.2, and 15.2 cm for all cultivars. Extra seed were planted on the end of plots in alleyways, and the plants removed at harvest to prevent yield differences as a result of end of row or border effect. All seeding was by hand placement of one seed at the desired spacing in an opened furrow. Other standard agronomic and production practices, including nematode, insect, and disease control, were used for all plots as recommended by the Virginia Cooperative Extension Service.

Plant measurements for main stem height and cotyledonary (n + 1) lateral branch length were made approximately the first of August of each year. Four plants were measured in each of the five replications. Taproots were counted at harvest to determine the average intrarow spacing between plants for each cultivar and each spacing. Final stand percentage was determined by dividing the number of taproots at harvest by the number of seed planted. Peanuts from each plot were combined with a small stationary picker, artifically dried, and yields corrected to a standard 7% moisture. Counts were made to determine pods/kg. Pods/m row and pods/plant were determined by using plot weight, taproot count, and pods/kg. Samples from each replicate were graded according to USDA procedures for peanut marketing. Grade data included percentages of fancy pods (nonshelled fruit that rode a 13.5-mm roller spacing on the presizer), extra large kernels (seed that rode an 8.5- x 25.4-mm slotted screen), sound mature kernels (seed that rode a 6.0- x 25.4-mm slotted screen), and total meat (all seed in the shelled sample including sound mature kernels, sound splits, other kernels, and damaged kernels). Market value ($/ha) was determined according to peanut price support schedules for each year of the test taking all grade characteristics into consideration. Gross value reported is the market value and net value refers to the gross value minus the cost of seed for that individual treatment.

Analyses of variance were determined for morphological characteristics, all market grade factors, yield, gross value, and net value each year. Error variances from these analyses were similar and indicated years could be pooled. Year x seed spacing interactions were not significant or either of such small magnitude compared to the main effects that they could be ignored, also indicating years could be pooled. Therefore, the means discusses are the averages of the 3-year study.

## Results and Discussion

The characters studied differed (0.01 probability level) among years due to environmental conditions. Cultivar differences (0.05 probability level) as expected were obtained for all characters except yield. Differences due to seed spacing were obtained except for percentages of fancy pods (FP), extra large kernels (ELK), and sound mature kernels (SMK). Since the seed spacing by cultivar interaction was significant for yield, gross value, net value, and some morphological characteristics, the data presented are from analyses within each cultivar over 3 years.

Increasing intrarow spacing decreased main-stem height and cotyledonary lateral-branch length (Table 3). Main stems were taller for each incremental decrease in seed spacing for all cultivars except VA 81B, which was not different at the 10.2- and 7.6-cm seed spacing. Cotyledonary lateral-branch length varied with seed spacing with significant differences recorded for all cultivars. These plant measurement results agree with those obtained by other researchers (2, 5) for virginia-type cultivars.

**Table 3. Effect of intrarow seed spacing on main stem height and lateral branch length for five peanut cultivars (1984 to 1986).**

| Cultivar | Seed Spacing | Main Stem Height | Lateral Branch Length |
|---|---|---|---|
| | ---- | ----cm---- | ---- |
| Florigiant | 5.1 | 41.5 | 54.0 |
| | 7.6 | 37.3 | 52.1 |
| | 10.2 | 35.4 | 52.1 |
| | 15.2 | 31.3 | 51.6 |
| LSD (0.05) | | 1.2 | 2.3 |
| NC 6 | 5.1 | 39.4 | 52.5 |
| | 7.6 | 35.3 | 50.0 |
| | 10.2 | 32.8 | 48.7 |
| | 15.2 | 28.9 | 46.4 |
| LSD (0.05) | | 1.1 | 2.1 |
| NC 7 | 5.1 | 43.2 | 49.6 |
| | 7.6 | 40.6 | 47.9 |
| | 10.2 | 37.2 | 46.9 |
| | 15.2 | 34.7 | 46.4 |
| LSD (0.05) | | 1.4 | 1.6 |
| VA 81B | 5.1 | 46.5 | 48.7 |
| | 7.6 | 42.3 | 46.8 |
| | 10.2 | 41.5 | 46.4 |
| | 15.2 | 37.4 | 43.9 |
| LSD (0.05) | | 1.4 | 1.6 |
| NC 9 | 5.1 | 43.0 | 54.9 |
| | 7.6 | 39.0 | 53.0 |
| | 10.2 | 36.9 | 51.2 |
| | 15.2 | 32.4 | 49.4 |
| LSD (0.05) | | 1.3 | 1.8 |

Taproot count at harvest permitted the computation of average plant spacing at harvest and final stand percentage, percentage of seed planted that produced a plant at harvest (Table 4). A trend toward higher final stand percentage with more distant seed spacings was observed; however, significant differences were not obtained among the seed spacings for final stand percentage with NC 6. NC 9 showed no consistent trend. Florigiant, NC 7, and VA 81B all had trends toward higher percentage of final stand with more distant seed spacing. Final stand was significantly higher at 15.2-than at the 5.1-cm seed spacing for these three cultivars. Since the seed used for each spacing came from the same seed lot and had the same germination, the final stand difference is thought to be due to plant competition, since emergence data were not obtained. Apparently, with closer spacing, the weaker plants were unable to compete during the growing season and died before harvest; whereas, with the more distant seed spacing, the weaker plants survived.

**Table 4. Effect of intrarow seed spacing on plant spacing and stand percentage at harvest for five peanut cultivars (1984 to 1986).**

| Cultivar | Seed Spacing at Planting | Plant Spacing at Harvest | Final Stand at Harvest |
|---|---|---|---|
| | ----cm---- | ----cm---- | ---%--- |
| Florigiant | 5.1 | 6.4 | 78.8 |
| | 7.6 | 9.4 | 80.9 |
| | 10.2 | 12.3 | 82.4 |
| | 15.2 | 17.8 | 85.8 |
| LSD (0.05) | | | 5.2 |
| NC 6 | 5.1 | 5.9 | 86.5 |
| | 7.6 | 8.7 | 87.6 |
| | 10.2 | 11.4 | 89.2 |
| | 15.2 | 17.1 | 89.2 |
| LSD (0.05) | | | NS |
| NC 7 | 5.1 | 6.9 | 73.4 |
| | 7.6 | 10.1 | 75.7 |
| | 10.2 | 13.0 | 77.9 |
| | 15.2 | 18.7 | 81.7 |
| LSD (0.05) | | | 3.5 |
| VA 81B | 5.1 | 6.1 | 83.1 |
| | 7.6 | 9.0 | 84.8 |
| | 10.2 | 11.5 | 88.2 |
| | 15.2 | 16.7 | 91.0 |
| LSD (0.05) | | | 5.3 |
| NC 9 | 5.1 | 5.7 | 88.8 |
| | 7.6 | 8.0 | 94.9 |
| | 10.2 | 11.0 | 92.0 |
| | 15.2 | 17.1 | 89.0 |
| LSD (0.05) | | | 4.6 |

Pod weights and counts were determined for each cultivar and seed spacing (Table 5). As expected, pods/plant for all cultivars increased significantly with each incremental increase in intrarow seed spacing. However, pods/m row did not increase significantly with each incremental increase in seed spacing, although each cultivar had a significantly greater number of pods/m row at the 5.1- than at the 15.2-cm spacing. The difference in the number of pods/m row between the 5.1- and 15.2-cm spacing was fairly consistent among cultivars, except for VA 81B. This cultivar produced 174 pods/m row at the 15.2- and 230 pods/m row at the 5.1-cm spacing or 56 pods/m row difference compared to 21 to 26 pods/m row difference for the other cultivars. VA 81B has an upright bunch growth habit with sparse vegetative growth and most of its fruit set near the taproot. Therefore, when seeded at closer intrarow spacing it produced more pods/m row than other cultivars.

**Table 5. Effect of intrarow seed spacing on pod characteristics for five peanut cultivars (1984 to 1986).**

| Cultivar | Seed Spacing | Pods/ m row | Pods/ plant | Pods/ kg |
|---|---|---|---|---|
| | ---cm--- | ----------number--------- | | |
| Florigiant | 5.1 | 222 | 15 | 540 |
| | 7.6 | 215 | 21 | 545 |
| | 10.2 | 206 | 26 | 542 |
| | 15.2 | 201 | 36 | 551 |
| LSD (0.05) | | 12 | 2 | NS |
| NC 6 | 5.1 | 218 | 13 | 569 |
| | 7.6 | 213 | 19 | 559 |
| | 10.2 | 207 | 24 | 560 |
| | 15.2 | 196 | 33 | 551 |
| LSD (0.05) | | 11 | 2 | 16 |
| NC 7 | 5.1 | 190 | 13 | 465 |
| | 7.6 | 184 | 19 | 470 |
| | 10.2 | 182 | 24 | 470 |
| | 15.2 | 164 | 31 | 459 |
| LSD (0.05) | | 13 | 2 | NS |
| VA 81B | 5.1 | 230 | 14 | 529 |
| | 7.6 | 209 | 19 | 523 |
| | 10.2 | 183 | 21 | 505 |
| | 15.2 | 174 | 29 | 514 |
| LSD (0.05) | | 14 | 2 | 17 |
| NC 9 | 5.1 | 213 | 12 | 558 |
| | 7.6 | 215 | 17 | 558 |
| | 10.2 | 195 | 22 | 547 |
| | 15.2 | 192 | 33 | 549 |
| LSD (0.05) | | 14 | 2 | NS |

Seed spacing did not affect size of the harvested pods as determined by the number/kg for Florigiant, NC 7, and NC 9. However, VA 81B produced larger pods at the 10.2-cm spacing than at 5.1 or 7.6 cm and NC 6 produced larger pods at the 15.2-cm spacing than at 5.1 cm.

Intrarow seed spacing had little effect on percentages of FP, ELK, SMK, or total meat content (TM) for the five cultivars studied (Table 6). Differences in market grades were not observed with seed spacing for NC 7, VA 81B, or NC 9. Only Florigiant showed a response for TM, where the 15.2-cm spacing was one percentage point greater than the percentage for 5.1 or 7.6 cm.

NC 6 had a significantly greater percentage of SMK at the 10.2-cm spacing compared to the other three spacings. Total meat percentage at the 10.2-cm spacing was significantly greater than the percentage at 5.1 or 7.6 cm, but not different from that at 15.2 cm. A response to seed spacing for FP was not obtained for any of the five cultivars.

Significant differences in grade characteristics for Florigiant and NC 6 were small and produced only small differences in market value. Other kernels, damaged kernels, and sound splits also were not significantly different among seed spacings for the five cultivars.

**Table 6. Effect of intrarow seed spacing on market grade characteristics for five peanut cultivars (1984 to 1986).**

| Cultivar | Seed Spacing | FP | ELK | SMK | TM |
|---|---|---|---|---|---|
| | ---cm--- | ------------%------------ | | | |
| Florigiant | 5.1 | 78 | 31.3 | 68.5 | 71.6 |
| | 7.6 | 77 | 31.9 | 68.7 | 71.6 |
| | 10.2 | 76 | 30.3 | 68.5 | 72.0 |
| | 15.2 | 78 | 31.2 | 69.3 | 72.6 |
| LSD (0.05) | | NS | NS | NS | 0.8 |
| NC 6 | 5.1 | 79 | 42.3 | 69.0 | 72.7 |
| | 7.6 | 80 | 44.0 | 69.8 | 73.0 |
| | 10.2 | 80 | 42.8 | 71.1 | 74.0 |
| | 15.2 | 80 | 42.7 | 70.0 | 73.4 |
| LSD (0.05) | | NS | NS | 1.0 | 0.8 |
| NC 7 | 5.1 | 91 | 54.7 | 71.6 | 74.7 |
| | 7.6 | 91 | 56.3 | 71.5 | 74.5 |
| | 10.2 | 92 | 55.3 | 71.2 | 74.3 |
| | 15.2 | 92 | 56.4 | 71.7 | 74.6 |
| LSD (0.05) | | NS | NS | NS | NS |
| VA 81B | 5.1 | 78 | 40.1 | 68.3 | 72.1 |
| | 7.6 | 79 | 40.5 | 68.7 | 72.3 |
| | 10.2 | 79 | 40.3 | 68.0 | 71.9 |
| | 15.2 | 76 | 40.2 | 69.2 | 72.7 |
| LSD (0.05) | | NS | NS | NS | NS |
| NC 9 | 5.1 | 84 | 31.7 | 70.1 | 73.1 |
| | 7.6 | 86 | 31.1 | 70.1 | 73.4 |
| | 10.2 | 86 | 32.8 | 69.8 | 73.1 |
| | 15.2 | 86 | 32.7 | 70.5 | 73.5 |
| LSD (0.05) | | NS | NS | NS | NS |

Cultivars responded differently in yield (kg/ha) with intrarow seed spacing (Table 7). NC 7 produced less at the 15.2-cm spacing than at either 10.2, 7.6, or 5.1 cm which were not significantly different. NC 6 and NC 9 had greater yields at the 5.1- and 7.6-cm spacing than at 15.2 cm. For these cultivars, the yield at 10.2 cm was not significantly different from that at either the 15.2-, 7.6-, or 5.1-cm spacing.

Florigiant yield at the 5.1-cm spacing was significantly greater than that at the 10.2- or 15.2-cm spacing but was not different from that at 7.6 cm. Yield at the 7.6-cm spacing was not different from that at 5.1 or 10.2 cm, but was different from that at 15.2 cm. Greater yields were recorded for each incremental decrease in seed spacing for VA 81B. The 5.1-cm spacing for VA 81B produced the greatest yield in this study and the 15.2-cm spacing for VA 81B produced the least. This may reflect the growth habit described earlier and supports the conclusions of other researchers (9) that this cultivar does best at higher plant populations.

Differences in gross value ($/ha), which is calculated from yield and price taking into consideration the grade characteristics, were similar to those for yield. Slight differences between yield and gross value were observed for VA 81B and NC 9.

**Table 7. Effect of intrarow seed spacing on yield, gross value, and net value for five peanut cultivars (1984 to 1986).**

| Cultivar | Seed Spacing | Yield | Gross Value | Net Value |
|---|---|---|---|---|
| | ---cm--- | kg/ha | ------$/ha----- | |
| Florigiant | 5.1 | 4441 | 2875 | 2567 |
| | 7.6 | 4273 | 2763 | 2557 |
| | 10.2 | 4125 | 2667 | 2513 |
| | 15.2 | 3973 | 2596 | 2493 |
| LSD (0.05) | | 216 | 154 | NS |
| NC 6 | 5.1 | 4156 | 2717 | 2401 |
| | 7.6 | 4112 | 2722 | 2511 |
| | 10.2 | 3995 | 2690 | 2532 |
| | 15.2 | 3835 | 2547 | 2442 |
| LSD (0.05) | | 219 | 174 | NS |
| NC 7 | 5.1 | 4398 | 2978 | 2646 |
| | 7.6 | 4237 | 2875 | 2654 |
| | 10.2 | 4191 | 2826 | 2660 |
| | 15.2 | 3881 | 2633 | 2522 |
| LSD (0.05) | | 222 | 162 | NS |
| VA 81B | 5.1 | 4671 | 3040 | 2734 |
| | 7.6 | 4313 | 2802 | 2598 |
| | 10.2 | 3909 | 2514 | 2361 |
| | 15.2 | 3642 | 2387 | 2285 |
| LSD (0.05) | | 249 | 190 | 190 |
| NC 9 | 5.1 | 4129 | 2716 | 2412 |
| | 7.6 | 4170 | 2742 | 2540 |
| | 10.2 | 3897 | 2546 | 2395 |
| | 15.2 | 3805 | 2512 | 2411 |
| LSD (0.05) | | 285 | 194 | NS |

Many reports on the effects of intrarow seed spacings include only yield and market grade data. Perhaps the most important basis for the peanut producer to determine optimum seed spacing is net value (gross value minus the cost of seed). For this study net value ($/ha) was calculated and reported (Table 7). Seed count and quantity of seed (kg/ha) for each spacing and cultivar were computed to determined the appropriate seed costs ($/ha). The seed cost was subtracted from the gross value to determine net value ($/ha). Using net value, significant differences among seed spacings for cultivars were not observed except for VA 81B, where the 5.1- and 7.6-cm spacings were greater even after subtracting seed costs than those for 10.2- and 15.2-cm spacings.

Based on this 3-year study of five large-seeded virginia-type cultivars, peanut producers have at least two choices for obtaining equal net returns. They may choose close intrarow seed spacings with greater initial seed cost or more distant intrarow seed spacing with smaller seed cost and still obtain approximately the same net return for the cultivars Florigiant, NC 6, NC 7, and NC 9. For VA 81B, the net return was significantly greater for the 5.1- and 7.6- cm seed spacings and should be considered for maximum net return for this cultivar.

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Accepted August 25, 1989