The Influence of Planting and Digging Dates on Yield, Value, and Grade of Four Virginia-type Peanut Cultivars[1]

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ABSTRACT

Obtaining maximum yield, value, and grade of peanut (*Arachis hypogaea* L.) by deciding the correct planting and digging date of various cultivars is a complex management decision. The influence of planting and digging dates on four large-seeded virginia-type cultivars was determined in a non-irrigated field study at the Tidewater Agricultural Experiment Station in Suffolk, Virginia, from 1983 through 1986. Florigiant, NC 7, NC 9, and VA 81B cultivars were planted at four 10-day intervals beginning about 23 April and harvested at five 10-day intervals beginning about 12 September. Significant differences occurred among cultivars and digging dates each year. NC 7 produced the highest yield, value, extra large kernels, and total kernels. Later digging dates produced higher yield, value, total kernels, and extra large kernels in 1983. The same was true in 1984 through digging date four when the yield and value declined for the fifth digging, while grade characteristics remained the same as digging date four. No significant changes in yield or value occurred after the second digging date in 1986 (22 September); however, total kernels and extra large kernels increased through the fourth digging date. Planting date affected yield only in 1983 (under moisture stress conditions) when each 10-day delay in planting after 29 April resulted in reduced yield and value, while in 1984 the earliest planting date of 20 April (under adverse weather conditions) was the lowest in yield and value. Significant digging date x planting date, digging date x cultivar, and planting date x cultivar interactions were obtained. These results indicate that cultivar selection and digging dates are more important than planting dates in normal years. However, since environmental stress conditions cannot be anticipated, early planting dates would seem to be an advantage when soil temperatures and moisture levels are conducive to good germination and seedling growth.

Key Words: Groundnut, *Arachis hypogaea* L., maturity, harvest date

Determining the optimum planting and digging dates for peanut (*Arachis hypogaea* L.) to achieve maximum yield and grade has been a goal of many researchers. Yearly variations in weather patterns affect the length of growing season as well as flowering date and pod development. As new cultivars are developed, the number of days required for each cultivar to reach maximum yield, grade, and value needs to be established. Shear and Miller (8) reported that under Virginia conditions the minimum length of time for Jumbo Runner peanut to reach optimum maturity was 148 days, with the earliest digging date for optimum maturity being about October 15. They reported that earlier as opposed to later planted peanuts were slower to reach flowering stage; thus, earlier planted peanuts required more days from planting to digging to obtain maximum fruit maturity. Maximum yield was reached before maximum shelling percentage or maximum percentage of extra large kernels was obtained in their study.

Pattee *et al.* (6) illustrated the complexities of peanut maturity in establishing the relationship of the seed/hull ratio to yield and dollar value. With some cultivars they found that yield and value increased with later harvest dates while other cultivars reached a peak and declined within the same year. Yearly variations were also noticed for cultivars. In another study, Pattee *et al.* (7) showed that the seed/hull maturity index is correlated to yield and value but this optimum index value must be determined for each cultivar.

Court *et al* (1), using one planting date and five harvest dates, found that delaying harvest date increased yield, sound mature kernels, and value of the spanish-type cultivar Comet and the valencia-type cultivar McRan. Knauft *et al* (2), also using one planting date and five genotypes harvested at three dates (105, 118, and 132 days after planting), found that earlier digging dates tended to reduce market grade characters. In their study without leafspot control, major yield differences were the result of genotype x digging date interactions. Mixon and Branch (3) conducted a 3-year study, with the full season runner-type cultivar Florunner and the short season spanish-type cultivar Pronto, using six harvest dates at 10-day intervals beginning 90 days after planting. Florunner harvested at 110 days and with each succeeding 10-day growth period up to 140 days, produced greater yields, more sound mature kernels, large and jumbo seed, and greater market value than Pronto. Pod yields of both cultivars, when averaged over the 3-year period, increased with each harvest date.

While previous studies have evaluated digging date effects, the objective of this research was to determine the planting and digging dates at which optimum yield, grade, and value could be obtained for four virginia-type peanut cultivars presently grown in the Virginia-Carolina production area.

Materials and Methods

Four large-seeded virginia-type peanut cultivars were grown in a randomized complete block split-split plot design at the Tidewater Agricultural Experiment Station in Suffolk, Virginia, from 1983 through 1986. The whole plots were five digging dates, the split plots were four planting dates (Table 1), and cultivars were the split-split plot. Of the four cultivars used, Florigiant and NC 9 had a spreading growth habit, NC 7 had

Table 1. Planting and digging dates used in 1983 through 1986.

	1983	1984	1985	1986
Planting Date				
1	29 April	20 April	22 April	26 April
2	10 May	30 April	1 May	3 May
3	19 May	10 May	10 May	13 May
4	30 May	21 May	20 May	23 May
Digging Date				
1	19 Sept.	10 Sept.	10 Sept.	12 Sept.
2	28 Sept.	19 Sept.	19 Sept.	22 Sept.
3	7 Oct.	28 Sept.	30 Sept.	2 Oct.
4	17 Oct.	8 Oct.	10 Oct.	10 Oct.
5	28 Oct.	18 Oct.	21 Oct.	20 Oct.

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Table 2. Mean squares from analyses of variance for yield (kg/ha), value ($/ha), and percentages of fancy pods, extra large kernels and total kernels for 1983, 1984, and 1986.

Source	df	Yield 1983	Yield 1984	Yield 1986	Value 1983	Value 1984	Value 1986	Fancy Pods 1983	Fancy Pods 1984	Fancy Pods 1986	Extra Large Kernels 1983	Extra Large Kernels 1984	Extra Large Kernels 1986	Total Kernels 1983	Total Kernels 1984	Total Kernels 1986
		(x 10^{-5})						(x 10^{-1})								
Reps	2	2.1	19.4*	21.4	3.2	7.9**	9.6	8.0	17.6	17.0	10.1	1.3	8.4	9.7**	0.6	0.1
Dig Date (DD)	4	86.7**	58.3**	113.8*	86.7**	60.7**	90.5*	9.3	4.8	13.3	293.3**	330.8**	233.9**	72.6**	51.3**	38.1**
Error A	8	3.4	2.2	28.3	0.9	0.8	13.9	3.9	6.2	4.9	2.4	3.7	2.5	0.3	0.6	0.2
Plant Date (PD)	3	100.8**	3.9	9.7	63.5**	2.0*	4.9	1.6	15.5**	2.0	169.7**	105.1**	60.9**	22.8**	3.1**	0.9**
DD x PD	12	8.0**	4.9**	7.0	4.0**	2.8**	4.6*	0.3	2.8	2.7**	6.4**	4.3**	10.2**	2.1**	0.5**	0.7**
Error B	30	2.6	1.3	3.5	1.1	0.7	2.0	0.8	1.9	0.7	0.8	1.0	1.1	0.3	0.1	0.1
Cultivar (C)	3	36.0**	13.1**	3.2**	30.9**	14.0**	4.0**	7.6**	290.6**	117.7**	394.7**	948.3**	519.1**	15.6**	4.7**	8.8**
PD x C	9	1.3	1.9*	2.6*	0.6	0.8**	1.3	1.6*	2.0	1.0	8.3**	2.0**	3.3**	1.1**	0.1	0.1
DD x C	12	4.0**	4.0**	4.3**	2.4**	2.0**	3.1**	1.1	2.8*	2.1*	7.6**	22.2**	5.8**	1.4**	0.3**	0.5**
DD x PD x C	36	1.3	1.0	1.5	0.6	0.5	0.8	1.0	1.3	1.1	1.1	1.3**	1.1*	0.4	0.1	0.1
Error C	120	0.9	0.8	1.2	0.4	0.4	0.7	0.8	1.4	1.1	1.6	0.6	0.6	0.3	0.1	0.1
CV (%)		6.9	7.3	7.5	8.6	8.2	8.3	3.2	4.5	3.8	10.8	8.9	6.1	2.7	1.4	1.2

*, ** Indicate 0.05 and 0.01 significance level, respectively.

an intermediate growth habit, and VA 81B had an erect growth habit (4).

This non-irrigated field study was conducted on an Eunola loamy fine sand (siliceous, thermic Aquic Hapludult). Plots were two rows 91.4-cm wide and 12.2-m long with three replications. Intrarow seed spacings were 10.2-cm for all cultivars. Other agronomic and production practices, including nematode, insect, and disease control, used in all plots were recommended by the Virginia Cooperative Extension Service.

The peanuts in each plot were dug with an inverter digger, allowed to field dry for 4-6 days, combine-harvested, cured, weighed, and pod yields adjusted to a standard 7% mositure level. Each year a pod sample for each treatment from each replication was graded according to USDA procedures for peanut. Grade data reported are percentages (weight/weight basis) of fancy pods, extra large kernels, and total kernels which includes sound mature kernels, sound splits, other kernels, and damaged kernels.

Analyses of variance were conducted for each year. Error variances from these analyses were significantly different among years indicating years should be reported separately.

Results and Discussion

Mean squares from the analyses of variance for yield, value, fancy pods, extra large kernels, and total kernels are presented for the years 1983, 1984, and 1986 (Table 2). The 1985 data are not reported. Rainfall (218.4 mm) on 27 September 1985 resulted in rapid vine deterioration which was affected by planting date and cultivar (5) and when combined with the two digging dates prior to the rainfall, resulted in data extremely inconsistent with other years.

Yield (kg/ha)

Cultivar, planting date, and digging date effects on yield were variable for 1983, 1984, and 1986 (Fig. 1). Cultivars were expected to differ since they are different genotypes with different yield potentials. They also differ in maturity with VA 81B being the earliest, NC 7 and NC 9 intermediate, and Florigiant the latest.

Planting date did not have a significant effect on yield except in 1983 when earlier plantings were significantly higher in yield than later plantings (Fig. 1). This difference may have been the result of rainfall distribution throughout these growing seasons during the critical flowering and pegging period of 25 June through 25 August. In 1984 and 1986 a total of 325 and 431 mm of rainfall, respectively, was recorded during this period; whereas, in 1983 only 100 mm were recorded for the same time period. However, 50 mm were recorded on 29 August 1983 and the plants started flowering and pegging profusely at this late date. The lack of moisture slowed vegetative growth of the later plantings; and once rain was received, they did not mature as rapidly as earlier plantings. This resulted in planting dates one and two yielding more than planting dates three and four.

Digging date effects were similar in 1984 and 1986 with yields increasing with later diggings through digging date four and then declining at digging date five (Fig. 1). Yield differences in 1983 were likely a result of the moisture condition previously mentioned. Later digging dates resulted in increased yield because the plants were continuing to grow but never reached their maximum size.

The cultivar x planting date interaction was significant in 1984 and 1986 (Fig.2). In 1983 all cultivars reacted the same with earlier plantings producing higher yields for reasons given above. However, in 1984 and 1986 some cultivars produced higher yields for later plantings and other cultivars higher yields with earlier plantings.

All years produced a significantly different cultivar x digging date interaction (Fig. 3). In 1983 all cultivars increased in yield with each delay in digging date, except the early-maturing VA 81B, which reached its maximum yield at the fourth digging date and then declined at digging date five. In 1984 and 1986 cultivar yields were not consistent over digging dates. This reflects the degree of maturity and yield potential of these four cultivars. VA 81B, an early maturing cultivar, yielded better at the earliest digging date; whereas, the other cultivars performed better at later digging dates.

Planting date x digging date interactions were significant in 1983 and 1984 but not in 1986 (Fig. 4). Pod yields in 1986 at all planting dates increased with delayed digging date and then declined after the fourth digging. In 1983 only yields from the first planting date reached a maximum and then declined with the last digging date. Yields that resulted from planting dates two through four were still increasing at the last digging date. However, in 1984 yields from planting dates one through three reached a maximum and then declined with later digging dates. Yields from planting date four remained steady for digging date five while the earlier three plantings declined in yield.

These yield data show the importance of the right combination of planting and digging dates to obtain maximum yield. Yearly environmental conditions that affect flowering, pegging, and pod maturity certainly influence potential yield.

Value ($/ha)

Value ($/ha) is a combination of yield multiplied by the price per kg. These data correlate very closely with yield (Fig. 5). Significant differences in value were observed each year within cultivars. Values for planting dates were significantly different in 1983 and 1984 but not in 1986. In 1983 earlier plantings produced greater value and in 1984 the first planting date produced the lowest value. Values for digging dates were significantly different each year. Pods from later diggings were of greater value in 1983. In 1984 and 1986 pod values increased through the fourth digging date and then declined in value by the fifth digging date.

The cultivar x planting date interaction was significantly different only in 1984 when the first planting date actually produced a lower value than later plantings for NC 7 and VA 81B. The cultivar x digging date interaction was significantly different each year. (Fig. 6). In 1983 values for all cultivars increased with delayed digging except for VA 81B which declined after the fourth digging. Values for all cultivars declined in value after the fourth digging date in 1984, but values for VA 81B and NC 9 declined more rapidly than

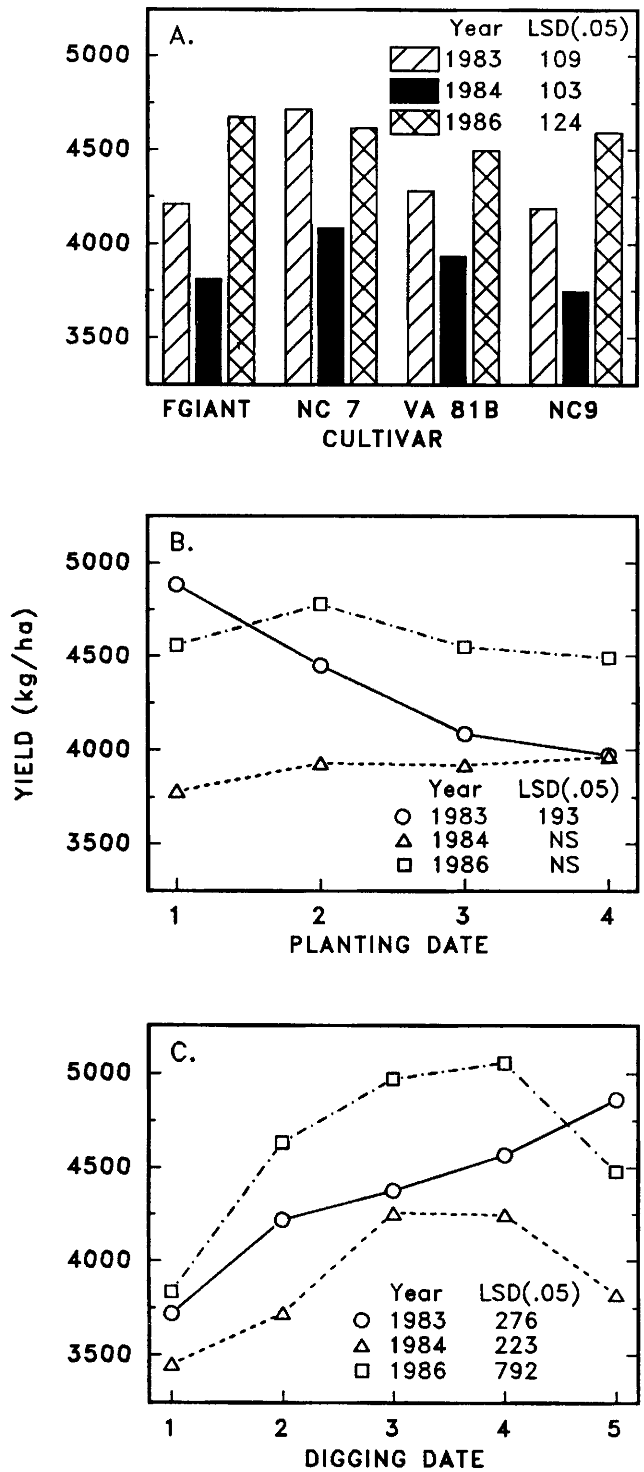

Fig. 1. Effects of cultivar (A.), planting date (B.), and digging date (C.) on yield.

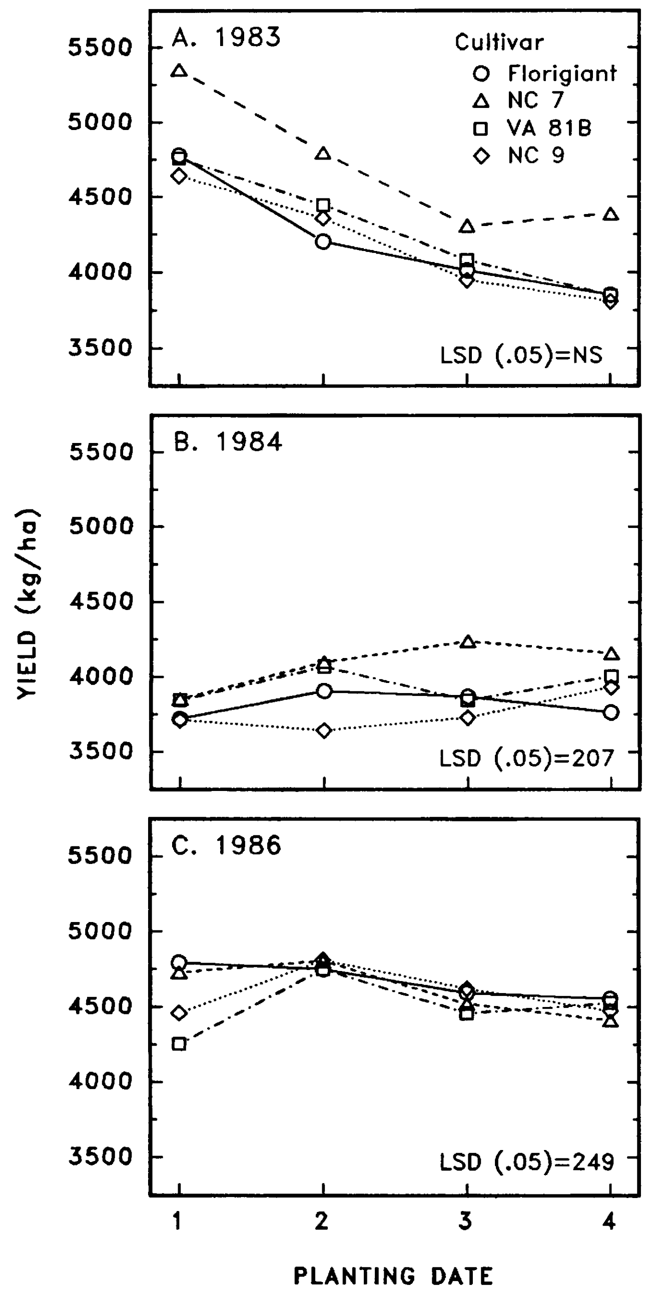

Fig. 2. Cultivar χ planting date interaction effect on yield. (A.) 1983. (B.) 1984. (C.) 1986.

those for Florigiant or NC 7. In 1986 values also declined after the fourth digging date with VA 81B showing the sharpest reduction. VA 81B is the earliest to mature and when coupled with delayed digging, the resulting pod loss meant lower yields and values.

Planting date x digging date interactions were significantly different each year (Fig. 7). Later digging resulted in a higher value for each planting date except planting date one in 1983 when the last digging date produced less value than digging date four. In 1984 values for all planting dates except planting date four were lower at digging date five than at digging date four. For planting dates, values increased through the fourth digging date. In 1986 values for all planting dates were increased with delayed digging through digging date four, but lower values were obtained for all planting dates at digging date five.

Fancy Pods (%)

Planting and digging dates had very little effect on percentage of fancy pods. In 1983, 1984, and 1986, percentages of fancy pods ranged from 86.9 to 88.2, 79.1 to 82.3, and 86.1 to 87.5, respectively for the four planting dates. Differences were small each year and significant only in 1984. This indicates that pod size developed rather rapidly and was not dependent upon planting or digging dates used in this study.

The proportion of fancy pods of the four cultivars were different each year. Significant interactions between cultivar and planting or digging dates were due to cultivar effects. Planting date x digging date interactions were significantly different only in 1986 when fewer fancy pods were obtained

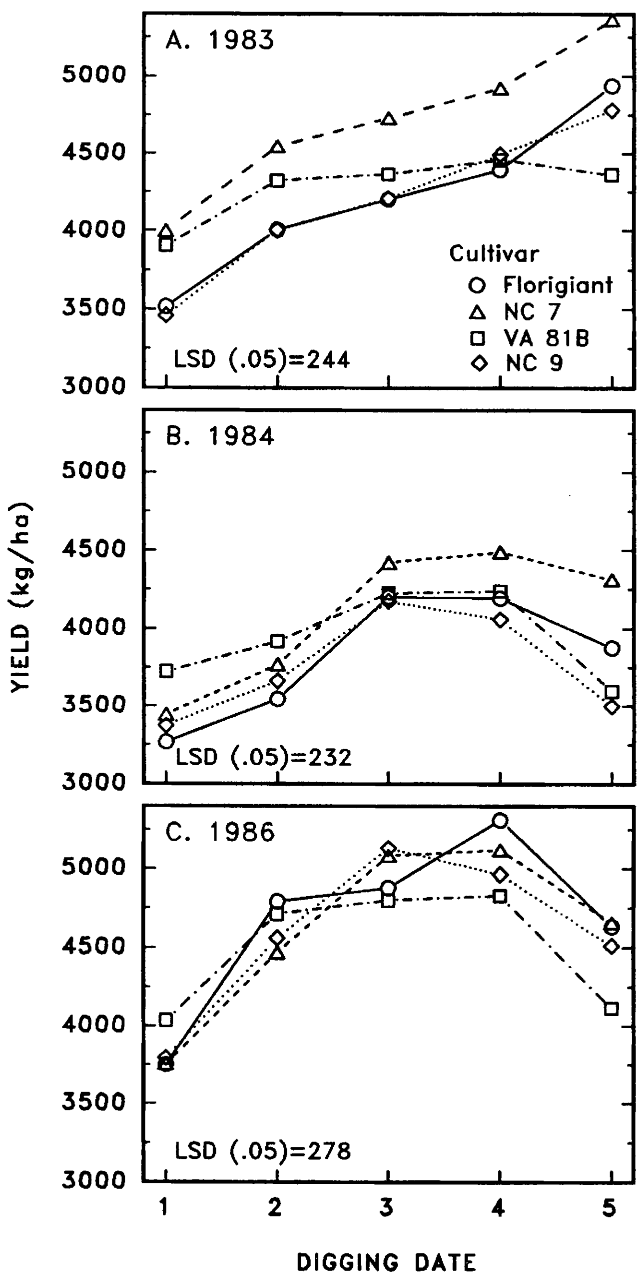

Fig. 3. Cultivar X digging date interaction effect on yield. (A.) 1983. (B.) 1984. (C.) 1986.

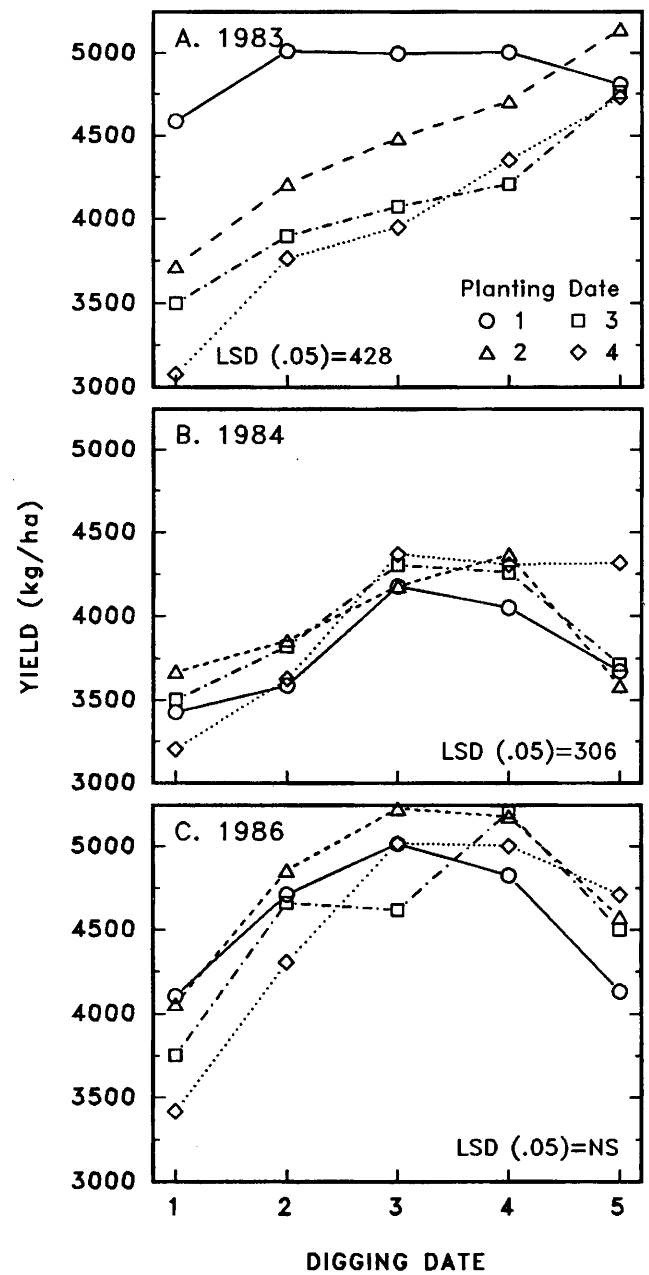

Fig. 4. Planting date χ digging date interaction effect on yield. (A.) 1983. (B.) 1984. (C.) 1986.

from the first planting date with each delay in digging date, but fancy pod percentages for the other three planting dates remained rather constant with each digging date.

Extra Large Kernels (%)

In contrast to fancy pod percentage, percentage of extra large kernels (ELK) was affected by cultivars, planting dates, and digging dates each year (Fig. 8). Cultivars were different due to genetic potential. Earlier planting dates resulted in a higher ELK percentage except for the first planting date in 1984 which had a lower ELK percentage than did the second planting date. Later digging dates showed a higher ELK percentage; however, the difference between digging dates four and five in 1984 and 1986 was minimal.

A significantly different cultivar x planting date interaction was obtained each year (Fig. 9). In 1983 VA 81B maintained approximately the same ELK percentage for the later three planting dates; whereas, NC 7, Florigiant, and NC 9 had lower percentages of ELK for each of the later planting dates.

All cultivars had smaller percentages of ELK for the first planting date than for the second planting in 1984. The third and fourth plantings resulted in fewer ELK than the second planting date. NC 9 and Florigiant had approximately the same percentage. VA 81B was superior to Florigiant or NC 9. NC 7 produced the highest ELK at each planting date.

In 1986, Florigiant and VA 81B had the highest ELK

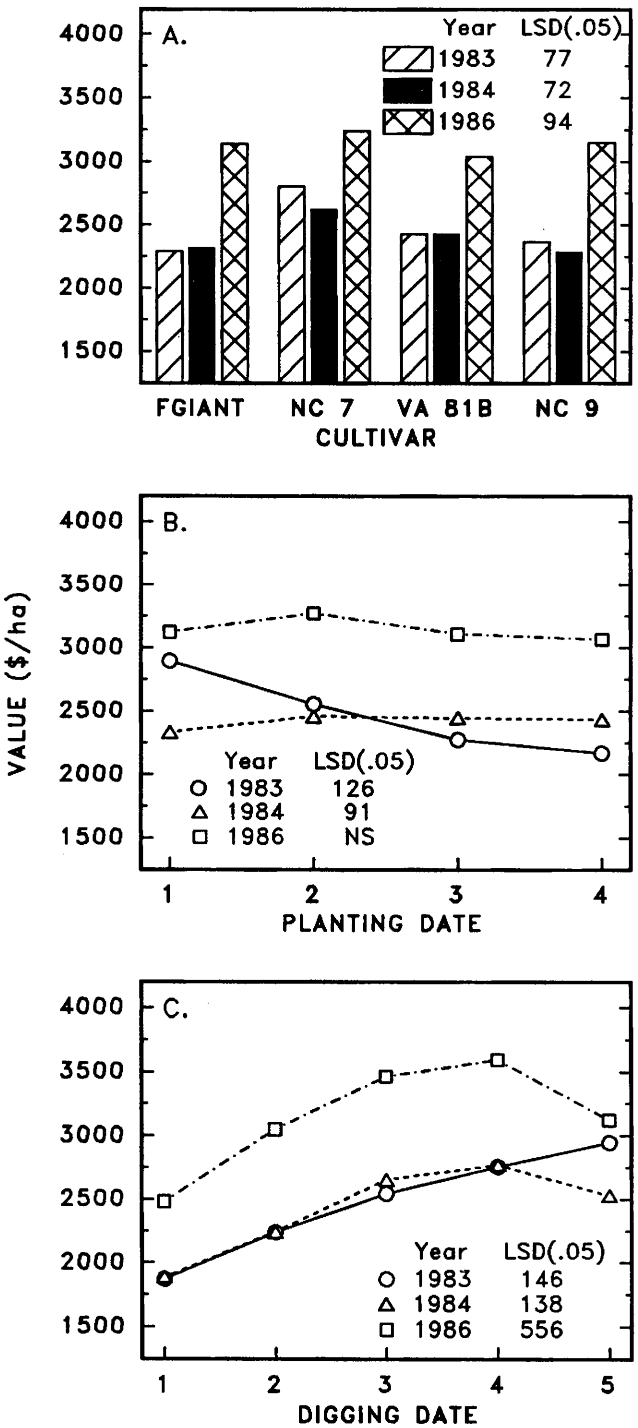

Fig. 5. Effects of cultivar (A.), planting date (B.), and digging date (C.) on value.

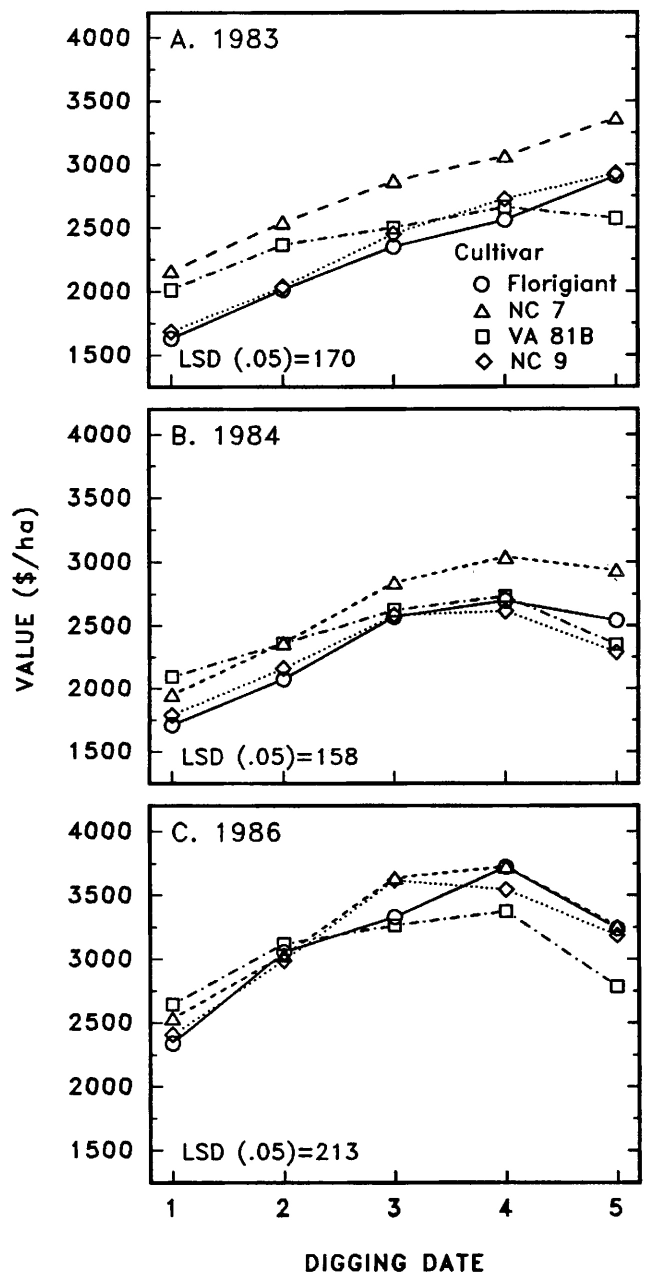

Fig. 6. Cultivar χ digging date interaction effect on value. (A.) 1983. (B.) 1984. (C.) 1986.

percentage at the second planting date with the third planting and first planting equal and the fourth planting date the lowest. NC 7 and NC 9 had the highest percentage at the first planting and with each delayed planting date a lower percentage of ELK was produced.

A significant cultivar x digging date interaction occurred each year. Both NC 9 and Florigiant had increases in ELK with later harvest dates. VA 81B and NC 7 produced higher ELK percentage than did Florigiant or NC 9. However, the differences widened with later diggings of NC 7 and narrowed with VA 81B creating a significant interaction.

The ELK interaction for planting date x digging date (Fig. 10) was significant in 1983 when maturity of the crop was delayed. Earlier diggings showed earlier plantings to have higher percentages of ELK. However, the differences between the planting dates narrowed with later digging dates. In 1984 and 1986 when maturity was less of a problem, the fourth planting date produced fewer extra large kernels until the fourth digging in 1986 and fifth digging in 1984 when all planting dates tended to produce approximately the same ELK.

Total Kernels (%)

Within a given cultivar the percentage of total kernels increased with maturity. Significant differences in total kernels percentages occurred for cultivars each year. NC 7

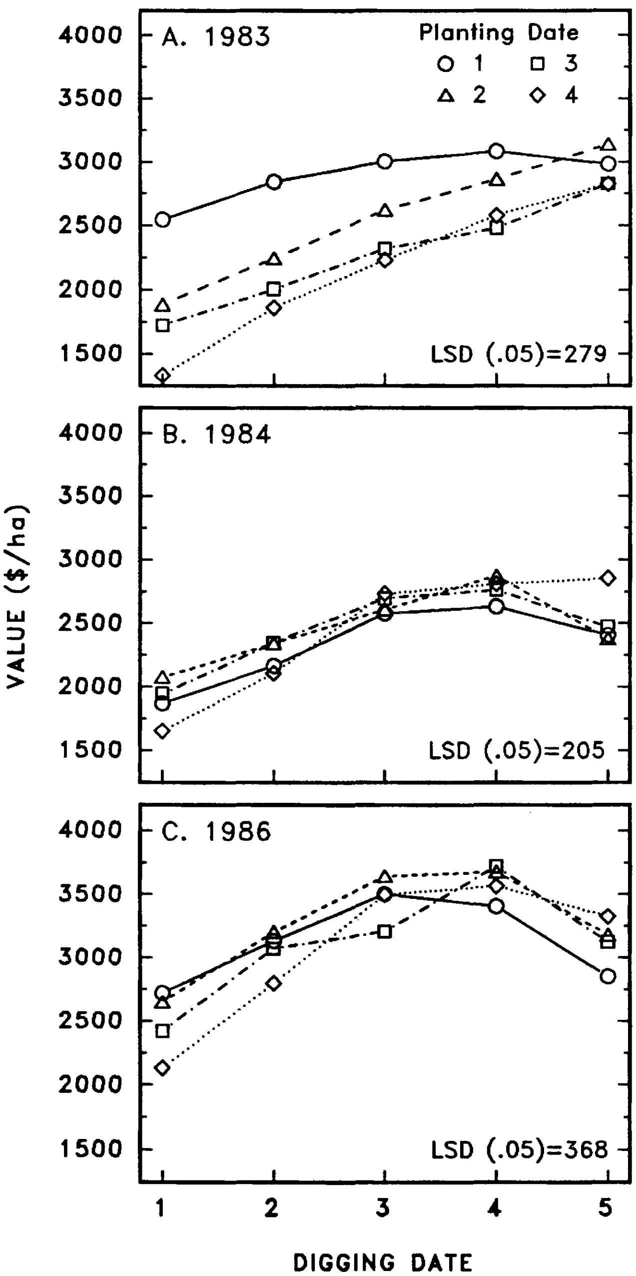

Fig. 7. Planting date χ digging date interaction effect on value. (A.) 1983. (B.) 1984. (C.) 1986.

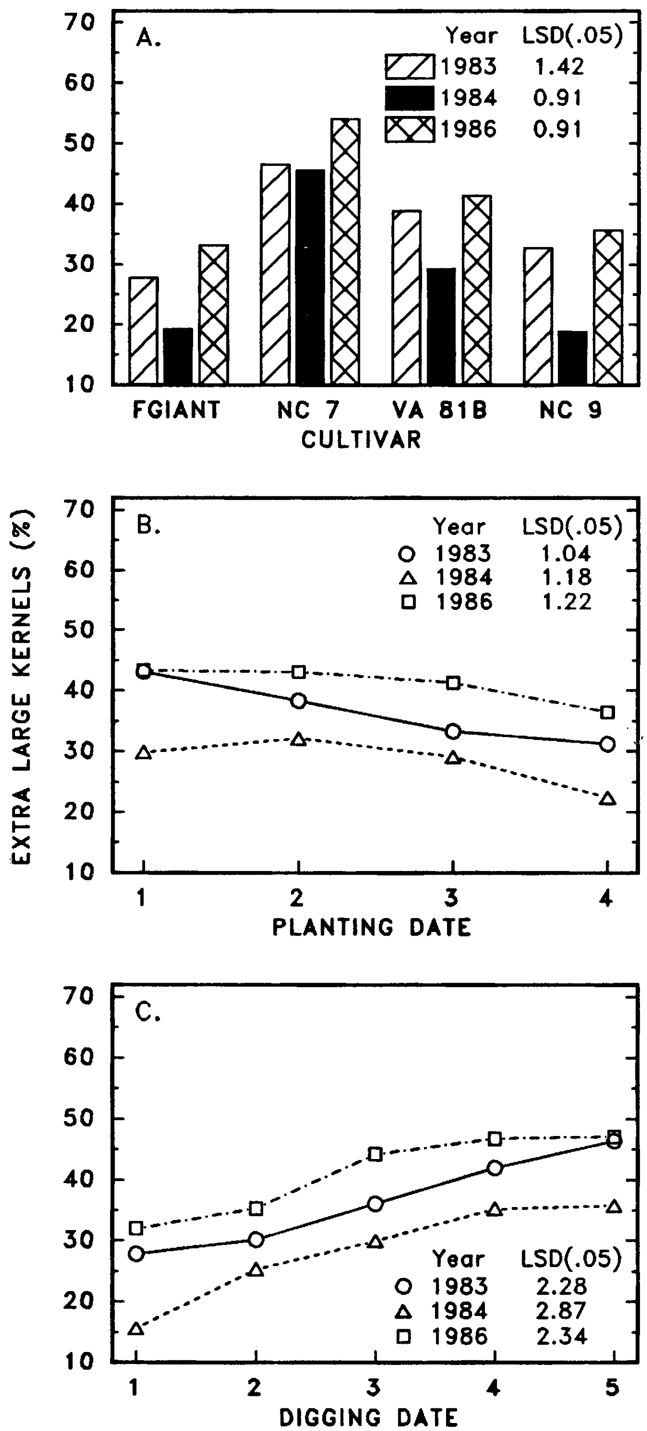

Fig. 8. Effects of cultivar (A.), planting date (B.), and digging date (C.) on percentage of extra large kernels.

had the highest percentage, VA 81B and NC 9 were intermediate, and Florigiant had the lowest percentage of total kernels. Later planting dates resulted in a smaller percentage of total kernels except in 1984 when the second planting date resulted in a higher percentage than either the first or third planting date.

Later digging dates resulted in a higher percentage of total kernels through the fourth digging with no significant differences obtained between the fourth and fifth diggings. A significant cultivar x planting date interaction was obtained only in 1983. However, the trend was the same as in 1984 and 1986 when a lower percentage of total kernels was obtained with delayed planting date, except the magnitude of difference was much greater for the later maturing Florigiant cultivar. This can be related to environmental conditions delaying maturity.

The cultivar x digging date interaction was significantly different each year (Figure 11). All cultivars tended to increase in percentage of total kernels with later digging dates, but the interaction resulted from the increase between digging dates. Earlier maturing cultivars VA 81B, NC 7, and NC 9 were higher in percentage of total kernels at earlier digging dates and did not increase as much at later digging dates as did the later maturing Florigiant.

Planting date x digging date interactions for total kernels percentage occurred each of the three years (Fig. 12). In 1983 planting date influenced total kernels until the fourth digging date. Differences between planting dates were not significant at digging dates four and five. In 1984 only the fourth planting date significantly reduced the percentage of

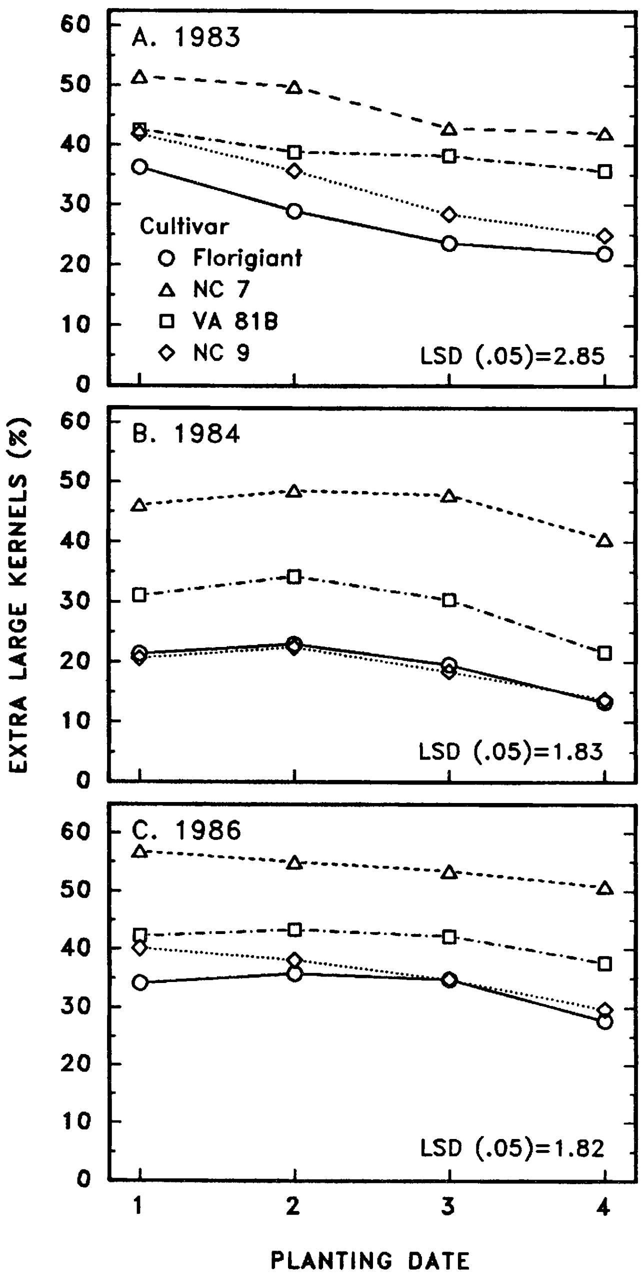

Fig. 9. Cultivar χ planting date interaction effect on percentage of extra large kernels. (A.) 1983. (B.) 1984. (C.) 1986.

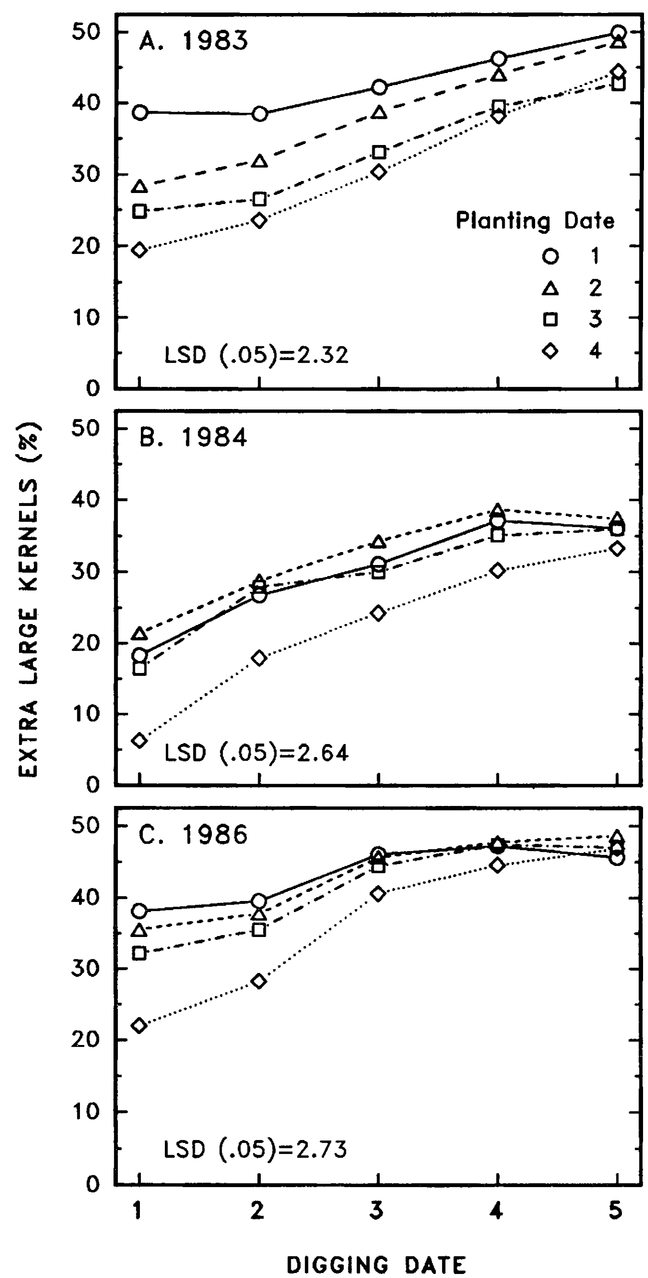

Fig. 10. Planting date χ digging date interaction effect on percentage of extra large kernels. (A.) 1983. (B.) 1984. (C.) 1986.

total kernels, but only at the first two harvest dates. The 1986 data show that later planting dates gave lower percentages of total kernels at the first two digging dates but no significant differences among later digging dates.

These results indicate that earlier planting dates are more favorable for higher percentages of total kernels on earlier digging dates. However, differences could be significant through the third digging date if environmental conditions cause a delay in normal maturity.

Conclusions

The results of this study show that cultivars differ in yield, value, and grade characteristics. Early planting dates were more important in years when maturity was delayed by environmental conditions or with early digging. In these situations early planting dates generally resulted in higher yield, value, and percentages of ELK and total kernels.

In years when environmental conditions resulted in delayed maturity, later digging dates resulted in higher yields, values, and grade characteristics. Years in which more normal environmental conditions were experienced, digging dates through date four resulted in yield and value increases but declined at digging date five. Extra large kernels and total kernels percentages continued to increase with each delay in digging date, although the amount of increase was not significant between diggings four and five.

These results indicate that cultivar selection and digging dates are more important than planting dates in normal years. However, since environmental stress conditions cannot be anticipated, early planting dates would seem to be an

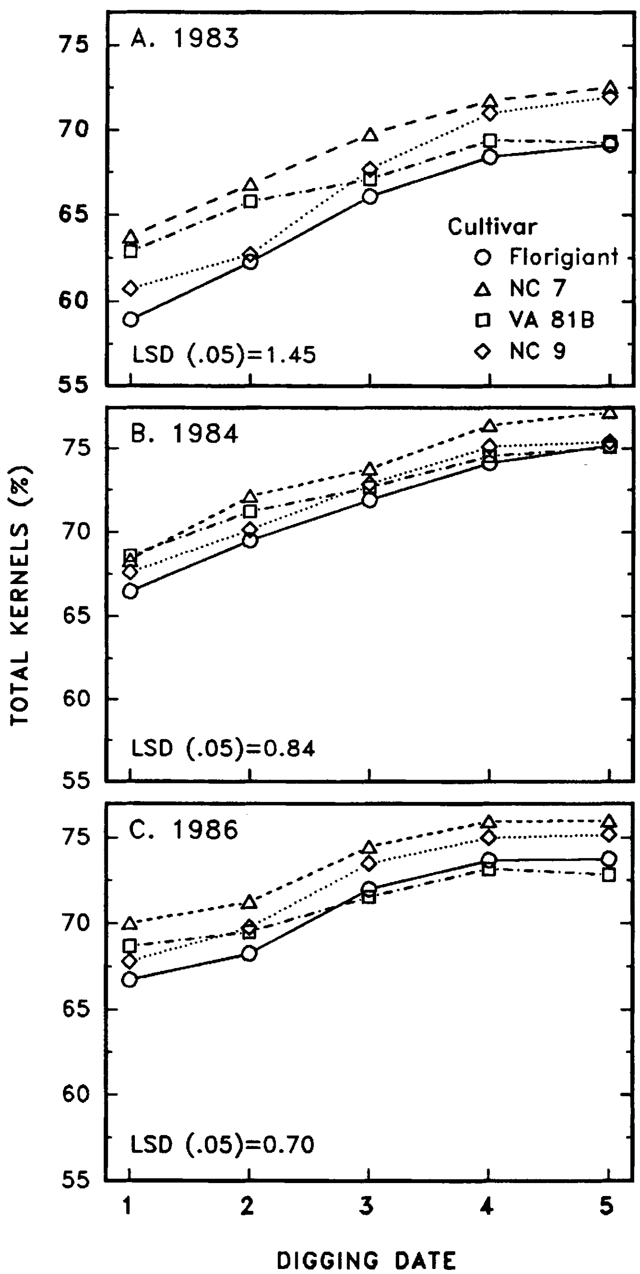

Fig. 11. Cultivar χ digging date interaction effect on percentage of total kernels. (A.) 1983. (B.) 1984. (C.) 1986.

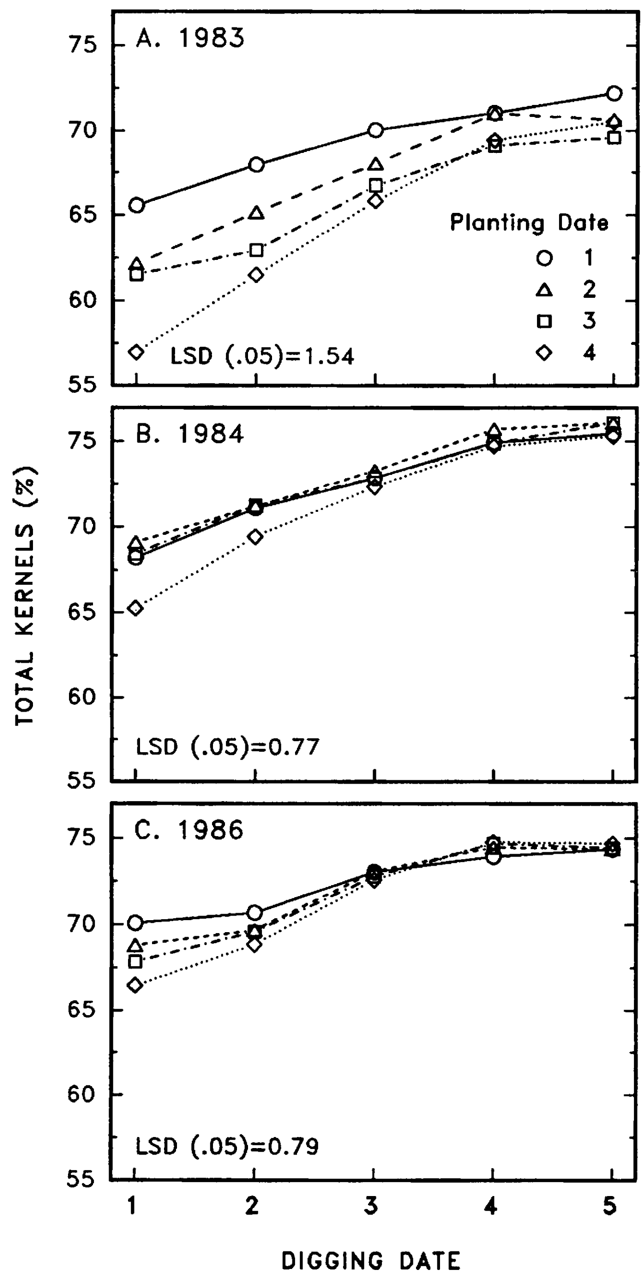

Fig. 12. Planting date χ digging date interaction effect on percentage of total kernels. (A.) 1983. (B.) 1984. (C.) 1986.

advantage when soil temperatures and moisture levels are conducive to good germination and seedling growth.

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