Nitrogen Management of New California Dark Red Kidney Varieties

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Background

The purpose of this project was to understand the effects of planting date and nitrogen fertilizer rate on the yield and quality of recently released dark red kidney (DRK) varieties. The new DRK varieties are long-season types and may be sensitive to day length if planted too early in the season. Also, the new varieties, Nichols and Vallejo, were developed under low N-input conditions; and therefore, may not benefit or may even be harmed with high rates of N fertilizer. Growers frequently apply fertilizer N for kidney production at rates greater than 100 lbs N/acre. These high nitrogen fertilizer rates may extend the period of vegetative growth, causing a delay in flowering, and impacting yield and quality.

Methods

We conducted 3 adjacent N fertilizer trials to determine the effect of planting date and N fertilizer rate (0, 50, 100, 150 lb of N/acre) on DRK yield, quality (size, cracks, canning quality), and growth habit (canopy size, stature). Trials were planted early-season (May 26), mid-season (June 12), and late-season (June 26). Dark red kidney varieties Nichols and Vallejo were compared with a standard variety (Cal DRK). The trial design was a randomized complete block layout with 5 replications (3 varieties × 4 fertilizer rates × 5 replications = 60 plots). Plots measured 50 ft × 4 rows with 10 ft alleys between plots. Seed was inoculated with rhizobia bacteria at planting. Dry urea fertilizer was banded adjacent to the seed line at sidedressing (4 true leaves). Emergence and developmental data were collected (Table 1). Dates of cultural practices for the three planting dates are presented in Table 2. The center 2 rows of the plots were cut and threshed for yield and quality measurements.

Table 1 Developmental Stages of Early, Mid, and Late Planted DRK Trials

	------- Timing of Planting -------		
Growth stage	Early	Mid	Late
	---------- Date ----------		
planting date	26-May	12-Jun	26-Jun
Emergence	31-May	18-Jun	29-Jun
4-6 true leaves	9-Jun	22-Jun	12-Jul
50% of plants with flowers	14-Jun	13-Jul	25-Jul
50% of plants with pods	29-Jun	26-Jul	10-Aug
100% of plants with flowers	10-Jul	20-Jul	15-Aug
100% of plants with pods	22-Jul	2-Aug	--
50% of plants with 2-3" pods	4-Aug	12-Aug	--
100% of plants with 2-3" pods	12-Aug	24-Aug	7-Sep
50% of pods yellow	12-Aug	24-Aug	12-Sep
Cutting	29-Aug	4-Sep	15-Sep
Threshing	8-Sep	25-Sep	27-Sep

TABLE 2 Cultural Practices for Early, Mid, and Late Planted DRK Trials

FIELD OPERATION	EARLY	MID	LATE
	--------- TIMING OF PLANTING -------		
	---------- DATE ----------		
planting	26-May	12-Jun	26-Jun
1st/pre-irrigation	--	12-Jun	24-Jun
N sidedress	9-Jun	22-Jun	12-Jul
2nd irrigation	12-Jun	24-Jun	14-Jul
3rd irrigation	24-Jun	14-Jul	28-Jul
4th irrigation	14-Jul	28-Jul	10-Aug
5th irrigation	28-Jul	10-Aug	23-Aug
6th irrigation	10-Aug	23-Aug	--
1st cultivation	22-Jun	22-Jun	13-Jul
1st furrowing	22-Jun	23-Jun	13-Jul
2nd cultivation	13-Jul	13-Jul	--
2nd furrowing	13-Jul	13-Jul	--
Mite spray	20-Jul	20-Jul	20-Jul

RESULTS

The first year of results demonstrated that the optimum rate of N fertilizer for maximum grain yield was approximately 75 lb of N/acre for early, mid, and late season plantings (Fig. 1), and for all varieties (Vallejo, Nichols, California DRK, Fig. 2). Yields were highest for the mid and late-season planting dates (Table 3). There were no significant differences in yield among varieties at the 95% confidence level for any of the individual planting dates. No interaction was found between the yield response to fertilizer N and planting date, nor was the interaction between yield response to fertilizer N and planting date significant. Canning quality data have not been fully analyzed, and therefore are not reported here. Total leaf N levels were lower in the Nichols variety than in varieties CDRK and Vallejo (Table 4). Petiole Nitrate and Total leaf N levels increased with increase rates of N fertilizer in all varieties; however, petiole nitrate levels responded the most from the application of fertilizer N (Fig. 3 and 4).

FIGURE 1 Applied Nitrogen *vs.* Grain Yield of Early, Mid, and Late Planting Dates (n=15, data pooled across variety)

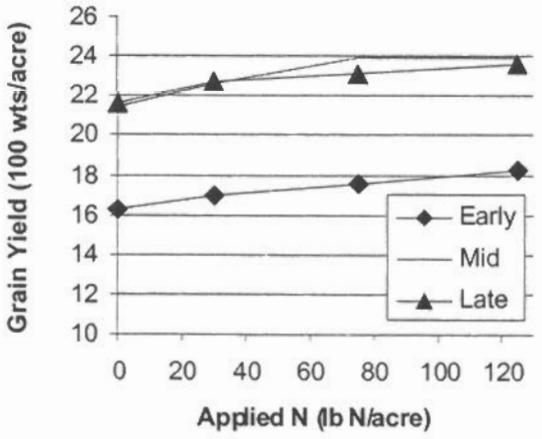

FIGURE 2 Applied Nitrogen *vs.* Grain Yield of CDRK, Nichols and Vallejo Varieties (n=15, data pooled across planting date)

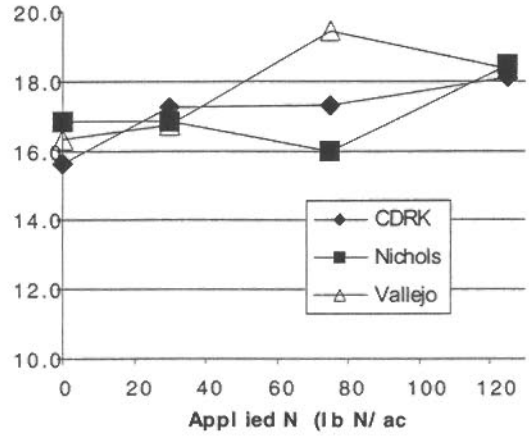

TABLE 3 Rain Yield of DRK Varieties Planted Early, Mid, and Late Season

VARIETY	OVERALL	PLANTING DATE EARLY	MID	LATE
		---------- 100 WT/ACRE ----------		
CDRK	20.81	17.06	23.91	22.47
Nichols	19.67	17.70	20.32	22.01
Vallejo	23.85	17.01	24.58	23.85
mean	20.62	17.26	22.94	22.77
CV	8.96	8.89	7.53	8.19
P > F	0.12	0.89	0.07	0.11
LSD 0.05	ns	ns	ns	ns

TABLE 4 Total Leaf Nitrogen of DRK Varieties Planted Early, Mid, and Late Season.

Variety	Overall	Planting Date Early	Mid	Late
		---------- % N ----------		
CDRK	4.26	4.72	4.45	3.60
Nichols	3.89	4.23	4.11	3.34
Vallejo	4.36	4.78	4.41	3.90
mean	4.17	4.58	4.32	3.62
CV	4.76	4.76	3.93	5.68
P > F	0.0002	0.07	0.01	0.05
LSD 0.05	0.18	ns	0.15	0.18

FIGURE 3 Applied Nitrogen Effects on Leaf Nitrogen Content of Early, Mid, and Late Season Planted DRK (n=9, data pooled across variety).

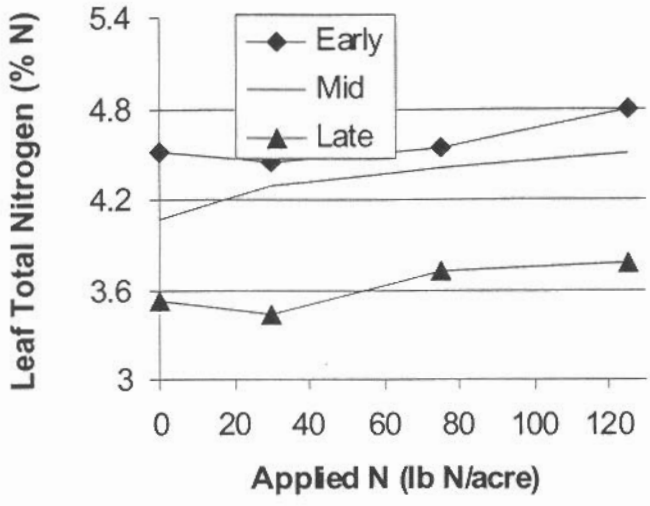
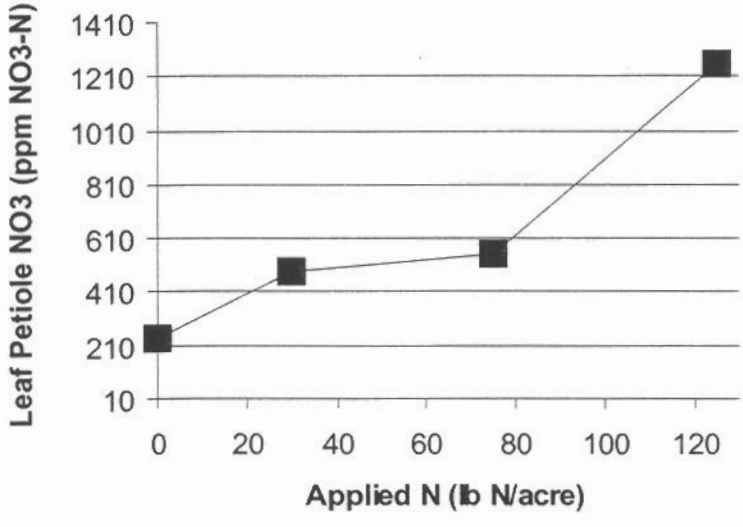
FIGURE 4 Applied Nitrogen Effects on Petiole Nitrate Levels of Mid-Season Planted DRK Varieties (n=9, data pooled across variety).