

by Dr. Alan D. Blaylock

Starters Bump Yields In Edible Bean Country

Wyoming researcher studies yield responses to variables in fertilizer applications and planting date.

Summary: In northern regions, reduced nutrient availability may slow early growth of early-planted dry edible beans (*Phaseolus vulgaris L.*). In a study conducted at Powell, Wyoming, to determine optimum planting time for these dry beans and the potential of nutrients to improve growth and yield, starter fertilizers significantly improved early growth. Yields averaged 250 to 300 lbs/A greater with N-P-Zn starter than with control treatments. Yields were greatest for late planting in 1994 and greatest for early planting in 1995. Response to starters was consistent among planting dates. Later plantings matured more quickly than early plantings, but more rapid maturity rate did not make up for planting delay.

Producers have observed that dry beans planted early in cool soils do not always mature earlier, and often yield less than beans planted in warm soils (60 to 70°F). The question thus arose: can starter fertilizers, which are not widely used, overcome some effects of early planting by improving early growth? Because early fall frosts and cool summers of recent years have resulted in significant crop losses, attention has been focused on practices that might promote earlier maturity. At our Research and Extension Center at Powell, Wyoming, we initiated studies to: 1) determine optimum planting time for dry beans, and 2) determine the potential of starter fertilizers to improve early growth and yield as well as hasten

maturity of early-planted dry beans.

Planting date

Weather effects. In 1994, warm, dry summer weather resulted in conditions generally favorable for bean production. Warm weather in September and unusually late frost allowed all plants

(regardless of planting date) to completely mature. Yields were good to excellent for the area.

In 1995, weather conditions during planting in mid and late May were cool and wet. Emergence was delayed, and average plant populations were less than in 1994 (69,000 vs. 99,000 plants/A).

Table 1. Fertilizer treatments for study at Powell, WY.

Treatment	N	P	Zn Formulation
Control	0	0	0
N (banded)	20	0	32-0-0
N-P (banded)	20	20	10-34-0 + 32-0-0
N-P-Zn (banded)	20	20	10-34-0 + 13-0-0-15Zn ¹ + 32-0-0
N-P-Zn (broadcast)	20	20	34-0-0 + 0-46-0 + ZnSO ₄ (35.5% Zn)

¹ Ammoniated Zn-ammine complex

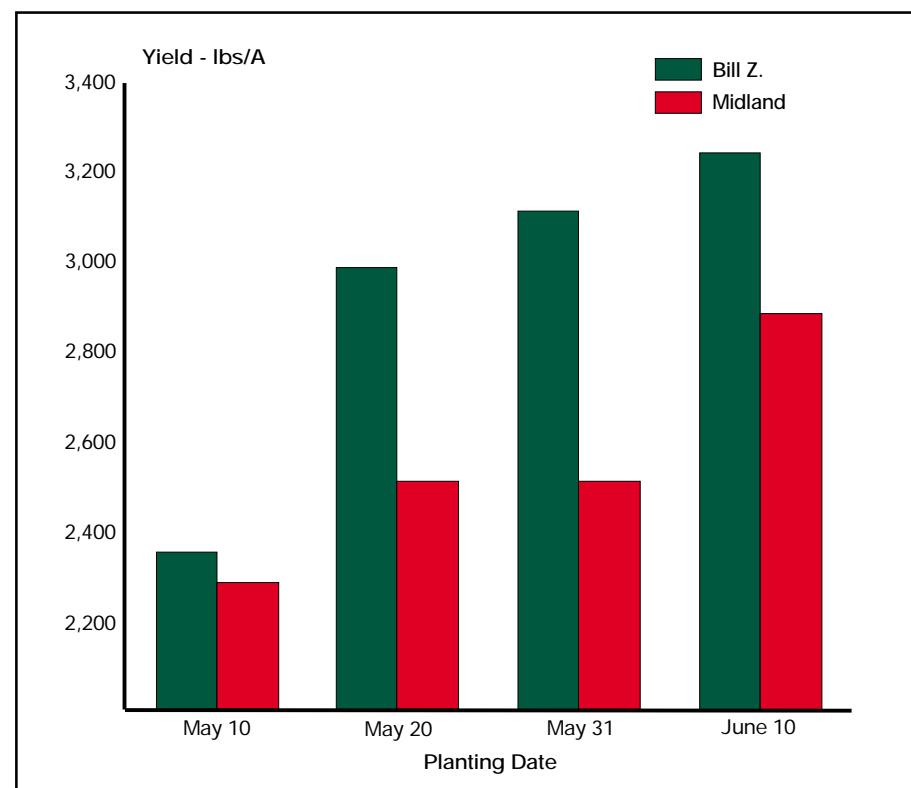


Figure 1. Dry bean yield response to planting date at Powell, WY, 1994.

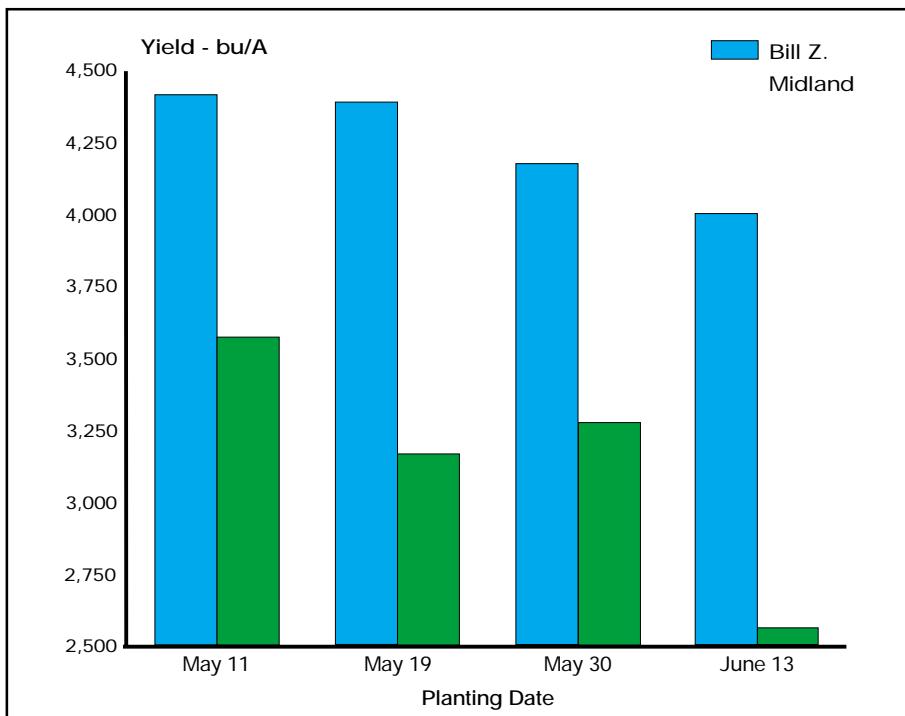


Figure 2. Dry bean yield response to planting date at Powell, WY, 1995.

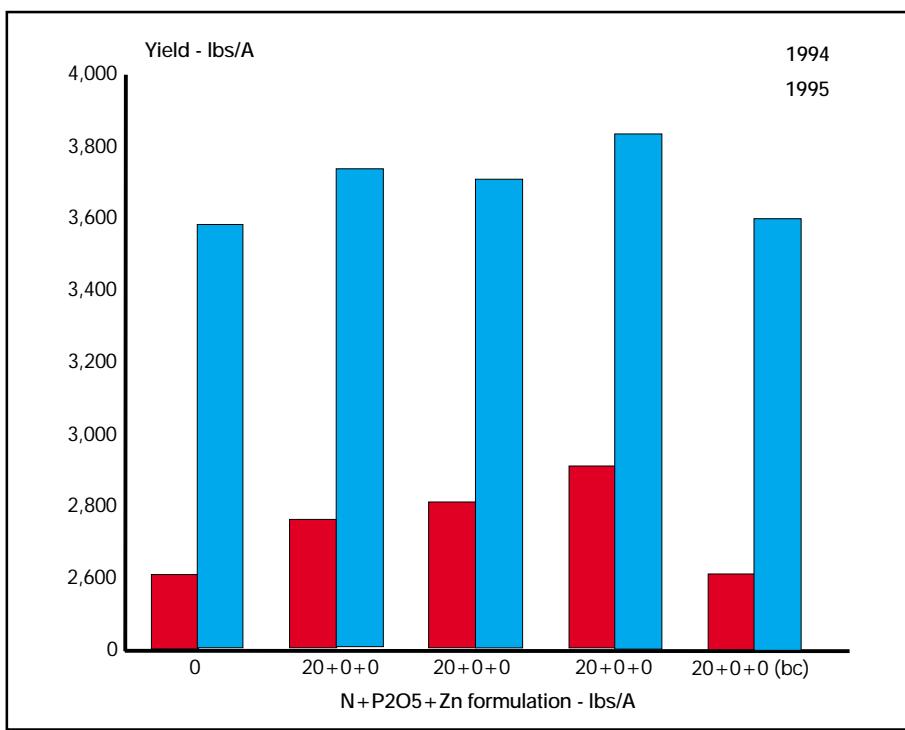


Figure 3. Dry bean yield response to starter fertilizers at Powell, WY.

Favorable weather conditions existed through mid and late summer. Though average populations were near or below the minimum proposed as necessary to maximize yield, yields were excellent and seemingly unaffected by the reduced plant populations.

Frost damage. In 1995, the June 13

planting was not completely mature when killing frost occurred on September 21. Though yields for this planting were good to excellent, harvested seed contained significant frost-damaged beans.

Hybrid variance. In 1995, average frost damage was 13 percent for Bill Z

pinto and 21 percent for Midland navy. It is uncertain how much of the yield reduction for the June 13 planting resulted from frost and how much was caused by other environmental factors. The reduction was likely greater for Midland than for Bill Z. Green pods were still present on Midland at the time of frost, but almost all of the pods on Bill Z had matured.

Mean yields were significantly greater for Bill Z pinto than Midland navy for all planting dates in both years (Figures 1 and 2). Bill Z plants were larger at V4 for all planting dates, but by flowering (RI), Midland plants were larger. Dry matter at pod fill (R8) was similar between varieties in 1994 and greater for Bill Z in 1995.

Growth. Early growth was greatest for late plantings but did not translate to greater yields in 1995. Early plantings emerge and grow slowly during cool weather. Flowering and pod fill then occurs during warm weather and long days. Late plantings grow rapidly during warm summer days but flower and fill pods during shorter (and usually cooler) late summer and early fall days. September temperatures were warmer than normal in 1994 and allowed late plantings to fill pods during warmer conditions.

Disease incidence. In 1994, disease symptoms were present throughout the plot but were most severe in the May 10 planting. Hot, dry winds during flowering seemed to cause some flower abortion, but no data were collected to verify this observation. Irrigation immediately after the May 10 planting created cold, wet soil conditions during germination and seedling development. Emergence time was longest for this planting and probably reflected conditions created by irrigation. Irrigating after this planting probably contributed to a greater incidence of

Fusarium root rot, a common bean disease in the area. The combination of cold, wet soil early, Fusarium root rot, and flower abortion is the likely cause of lower yields in this planting.

Fusarium root rot was also present in 1995 and was more prevalent in early plantings. Considering the very high yields observed, it is unlikely that disease or adverse conditions reduced yields in 1995. Furrow irrigation after planting in 1994 was probably more detrimental to bean - seedling growth than the conditions created by the rainfall that occurred in 1995. Irrigation more thoroughly saturates the soil and temporarily creates an oxygen deficiency.

Starters

Treatments. Starter fertilizer treatments significantly affected early growth and final yield (Figure 3). There was a significant yield increase with N-only starter, and a consistent, if not significant, additional yield increase with Zn added to the starter. There was little or no benefit from P additions. Dry matter at V4 increased with P addition in 1995, but yield did not increase correspondingly. Greatest yields occurred with the N-P-Zn starter, but the same combination broadcast before planting had no significant effect. Starter fertilizer did not significantly affect dry matter at R8. Yield responses in this study occurred in spite of high levels of soil or fertilizer N, adequate soil-test levels of P, and very high soil-test Zn.

Planting date. Response to starters was consistent among planting dates as evidenced by the lack of significant planting date x fertilizer interactions. Within planting date, larger plants early in the season seemed to relate to greater seed yields. The author speculates that nutritionally healthier plants early in the

season initiate more pods and seeds, resulting in a greater photosynthate sink. During pod fill, greater dry matter accumulates in the seed at the expense of vegetative growth.

Hybrid. Growth and yield were more strongly affected by planting date in the Midland variety than in the Bill Z. In both years, the variety x fertilizer interaction was significant only for V4 dry matter, with less response for the Midland variety than for Bill Z.

Maturity. Starter treatments significantly affected maturity. One or two days can make a significant difference in seed quality if beans are nearing maturity at the time of frost. The N-only starter delayed maturity compared with the other treatments in 1995. Mean differences in days-to-maturity would be considered negligible under normal field practices. But, according to orthogonal contrasts for the planting date x fertilizer interactions, there were significant differences in frost damaged-seed percentages for the June 13 planting in 1995. All the plantings in 1994 and the first three plantings in 1995 completely matured before frost. The major effect of starters on seed damage was in greater damage with the N-only starter. N-P-Zn starter had damage percentages similar to the control. In previous research at Powell, Zn applications consistently hastened maturity, even in the absence of yield response. This was only observed in the latest 1995 planting of this study.

Procedure

Treatments. Experimental design was a randomized complete block with four replications of each treatment in a split-strip-plot arrangement. Sub-subplots were given five fertilizer treatments (Table 1).

Site. Soil at the site was Garland clay loam. Previous crop was malting barley.

Soil was sampled in April to depths of 0-6 and 6-12 inches. Alachlor and EPTC were incorporated for weed control. The plot area was corrugated and planting-date treatments were irrigated as necessary before planting.

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