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Nitrogen fertilizer application timing in 'beauregard' sweetpotato

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Abstract. Although sweetpotato storage root production is acceptable without supplemental nitrogen (N) fertilization, yields are only a fraction of the yield potential for certain cultivars. Incremental rates of fertilizer N application generally result in proportional increases in storage root yield up to a certain level of N. In certain situations, the addition of fertilizer N does not elicit any yield response. This lack of yield response to a range of fertilizer N is attributed to several factors including microorganism activity, differences in N mobilization and immobilization, leaching, dinitrification, volatilization, residual N, cultivar effects, and application timing. Application timing, including split applications may increase N use efficiency and possibly achieve yield response with added N. Evaluation of the response of 'Beauregard' to seven application timing treatments (50 kg·ha^{-1} pre-plant, split [25 kg preplant+25 kg 28 days after transplant, DAT], 21, 28, 35, and 45 DAT) indicate that split application had the highest U.S. No. 1 storage root yield, resulting in 25% and 38% increase over pre-plant and 0 N applications, respectively. This was followed by 21 DAT (20%, 33%) and 28 DAT (3.4%, 9.8%). Applications at 35 and 45 DAT generally resulted in yield reduction (-10%, 8%) and (-32%, -9%), respectively. The results show that application timing suggests a more efficient use of N fertilization in 'Beauregard.' Application beyond 28 DAT generally results in yield reduction. The results provide growers with management options that increase fertilizer N efficiency.

Introduction

Nitrogen (N) fertilizer is an integral component of sweetpotato production and efficient management of this nutrient is prerequisite to the sustained commercial production of sweetpotatoes in certain production systems. A certain amount of nitrogen is necessary for shoot development and photosynthetic activity required for the growth of storage roots (Kays, 1985). Insufficient nitrogen can reduce yield potential of a sweetpotato crop. On the other hand, excessive nitrogen application does not increase yield and represents unnecessary waste of resources as well as potential source of contamination of surface and ground waters.

The objective of nitrogen management is to maximize the use of the nutrient and minimize potential leaching and possible contamination of surface and ground water. This requires evaluation of nutrient needs, inventory of nutrient supply, as well as assessment of nutrient balance.

Split applications of nitrogen fertilizers may increase N use efficiency (Guertal and Kemble, 1997). Fertilizer N (18 kg ha^{-1}) recovered in foliage and storage roots is maximum when applied 6 and 12 weeks after planting, respectively (Hill and Bacon, 1984). This information suggests that either post-plant or split applications may increase N utilization efficiency. Sweetpotatoes sidedressed 21days after transplant (DAT) with 50 kg ha^{-1} N yields the highest percent of U.S. No. 1 grade roots (Mulkey *et al.*, 1994). On the other hand, supplemental N application

(30 kg ha^{-1} applied preplant) 40 DAT results in reduced yield (Miller and Covington, 1982). Currently, the recommended application timing for nitrogen in Louisiana is either preplant or as side-dress 25-30 DAT (Boudreaux, 1999).

Materials and Methods

The experimental trials were conducted in Chase, LA on Gilbert silt loam (Gilbert series: fine-silty, mixed, thermic Typic Glossaqualfs). Randomized complete block designs were used for two planting dates (PD), each with four replications. The following timing treatments (TT) were used: 50 kg ha^{-1} pre-plant N, split [25 kg preplant + 25 kg 28 days after transplanting (DAT)], 21, 28, 35, and 45 DAT. The two planting dates were 4 June 2003 and 11 June 2003.

The plots were irrigated with 2.5 mm after transplanting. Rainfall during the growing season was more than 370 mm. Hand weeding was conducted whenever necessary. Plots were harvested after 105 days and the storage roots were graded and weighed into U.S. No. 1 (5.1 to 8.9 cm and 7.6 to 22.9 cm length), canner (2.5 to 5.1 cm in diameter and 5.1 to 17.8 in length), and jumbo (larger than both groups but marketable). Due to the absence of interaction between planting dates and timing treatments, data from both tests were combined and subjected to analysis of variance (ANOVA) using GLM procedures of SAS (SAS Inst., Cary, N.C.).

Results and Conclusions

There were differences detected among the economically imortant U.S. No. 1 yield grade for the first planting date (P=0.04, data not shown). No differences were detected in the second planting date. The combined data shows that split application (P=0.18) had the highest U.S. No. 1 yield at 35 mt ha^{-1}, followed by applications at 21 (33 mt ha^{-1}), 28 (27 mt ha^{-1}) DAT, and preplant (26 mt·ha^{-1}) (Figure 1). Partial budget analysis shows that a grower will gain 32% revenue using split vs. preplant fertilizer N application. Split application potentially represents an approach in increasing N fertilizer efficiency.

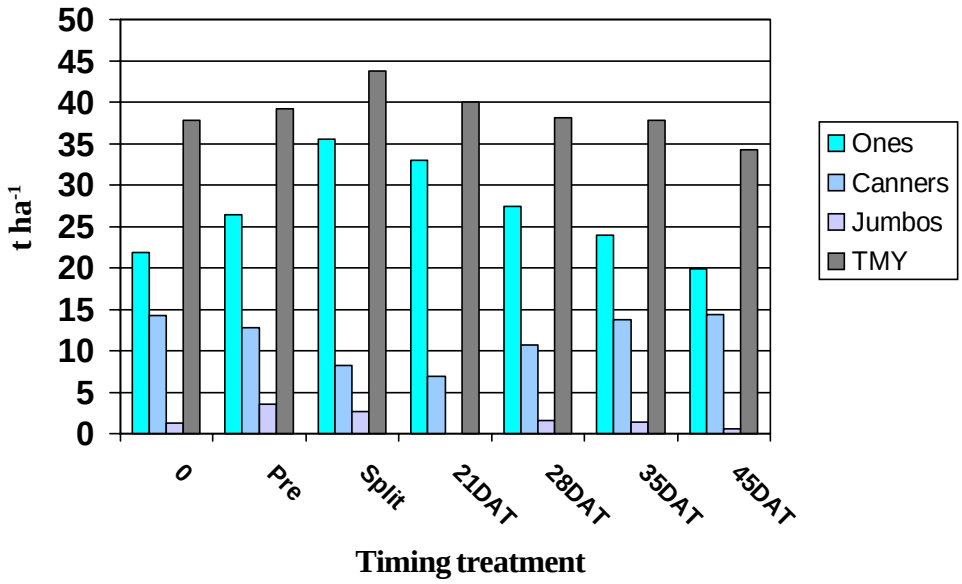

Figure1: Yield response of "beauregard' sweetpotato to nitrogen timing treatment, combined data, Chase, La, 2003.

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