Identifying resources in ex-PVP maize germplasm for improving nitrogen use efficiency

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Introduction:
- The World Summit on Food Security stated that the world must increase food production by 70% by 2050 in order to meet the demands of the growing world population and increase agricultural production to meet the needs of the most vulnerable populations. The United Nations Food and Agriculture Organization (2009a).
- The U.S. Department of Agriculture (USDA) found that nitrogen use efficiency (NUE) is critical to sustaining future yields while reducing costs and inputs per unit of yield (USDA, 2011).

Objectives:
1. Identify the yield components that are most responsive to increased nitrogen within various heterotic groups.
2. Determine where breeders should focus their efforts to improve maize nitrogen use efficiency (yield increase per unit of applied N).

Check Plot Yield:
- Table 1: Check plot yield and yield component averages for the different HGs.

How Was the Maximum Yield Achieved?
- Figure 2 demonstrates the general trend that higher yields are achieved through a greater response to applied N.

Materials and methods:
- This experiment was conducted during 2011 at the University of Illinois Department of Crop Sciences Research and Education Center at Champaign-Urbana, IL. The test type was a Drummer-Flanagan soil association (Typic Endoaquolls) with adequate P and K fertility.

Table 1: Average yield and yield component means for the different HGs.

ANOVA Separation of Means:
- Table 2: Significant differences between hybrid means for yield and yield components.

Conclusions:
- Differences in the average parental performance (GCA) can be detected at every N level, but individual hybrid (SCA) performance is of greater importance at low N levels (Table 2).
- Based on the various GCA estimations, there was less changing of rank and more significant differences between the male lines when compared to the female lines suggesting that there is less genetic variation found within the female HGs than within the male HGs (Table 3).
- Yield and yield component responses are relatively heritable at low N (Table 4).
- There is a generally positive trend in the relationship between check plot yield and maximum yield (Figure 1).
- The hybrids with the largest N responses simultaneously increased kernel number and kernel weight (Figure 2 and Table 6).
- Focusing on these key aspects, breeders should focus on increased yield at low N, as well as optimizing kernel number and kernel weight responses to N. Greater genetic variation for these traits may be present in male HG germplasm.
- Lastly, hybrids with these ideal characteristics are already in the market. Now the goal is to improve them beyond their current state.

Table 2: Significant differences between hybrid means for yield and yield components.

Table 3: Significant differences between HG means by male HGs.

Table 4: Hybrid yield at 252 kg N ha-1 mean yield and yield component responses to applied N for the six discussed hybrids.