INTENSIVE MEASUREMENTS IN SINGLE FIELD VS. TRADITIONAL MULTI-LOCATION P RATE STUDIES FOR LOCALIZED P RECOMMENDATIONS

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INTRODUCTION

With the advances in precision technologies over the past decade, there is more interest in individual farmers developing their own individualized research base. There are several stated advantages of individual farmers developing their own research base including; the accumulated data is from their own farm and reflects their environmental conditions, the results reflect an individual farmers cultural practices and rotations as compared to 'average' conditions, collecting many data points from a single field will result in less variability than data collected across a wide geographic area and numerous fields, and new precision technologies allow for easily collecting many more measurements from field size plots than in the past.. At the same time, there may be several potential challenges associated with this approach, including; traditional databases include data from a wide range of locations, environments and years which may provide for better overall predictability expected crop response, individual fields are typically variable and may make identifying trends in the data difficult and there is the potential for individual farmers to make decisions too quickly (and moving to something else) since the data is from their own operation.

The objectives this work were to 1) determine if one or two years of data collected from an individual field provides sufficient information on which to identify the strength of a correlation between P soil test value and corn grain yield for that particular field and 2) to evaluate the potential of new precision technologies for developing farmer research based individualized management programs.

MATERIALS AND METHODS

A field study was located on a farmer-cooperator field adjacent to the KSU Kansas River Valley research field near Topeka, KS. The field was sprinkler irrigated with one-half of the field in a corn-soybean rotation and the other half in a soybean-corn crop rotation. Thirty foot wide fertilizer P application rate treatment strips were made the length of each one-half of the field in the spring of 2002. Each strip was about one-half mile long. Fertilizer P application rates were 20, 40, 80 and 120 lbs P2O5/A, with two zero application check strips. After application, the fertilizer P was incorporated with a disk and a seedbed prepared. In 2003, no additional fertilizer P was applied while the same fertilizer rates were repeated to about two-thirds of the appropriate rate strip in 2004.

Fifteen sampling locations along the length of each strip were identified and addressed with a GPS/mapping system. This resulted in 15 non-randomized replications of each treatment. All soil samples and corn harvesting was done at these identified sampling locations for 2002, 2003 and 2004. Soil samples were collected from each individual sampling location prior to planting each spring and consisted of compositing 12-15 individual cores within an 8-10 foot radius around each point. Soil samples were collected from the surface 6-7 inches.

Bray P1 and Olsen P determinations were conducted at the Kansas State University soil testing laboratory while Servi-Tech Laboratories performed M3-Col and M3-ICP determinations from the same prepared soil samples. Corn yield determinations were made by hand harvesting two 10 foot long rows at each sampling location. All grain yields were adjusted to a 15.5% moisture basis.

Yield sufficiency in 2002 and 2004 was calculated by dividing the check plot yields by the highest yielding P treatment in each individual replication. Since there were no fresh P applications in 2003, yield sufficiency was estimated by dividing the sampling point yield by the average for all sampling locations having a soil test value greater than 30 ppm Bray P1 since all plots were 'check plots'. Regression analysis was used to evaluate the relationships among each soil test extractant/procedure and crop grain yield.

The Mitcherlich equation was used to model crop response to P soil test value.

Mitcherlich Model ---- Yield = c - (b * exp (PST x c))

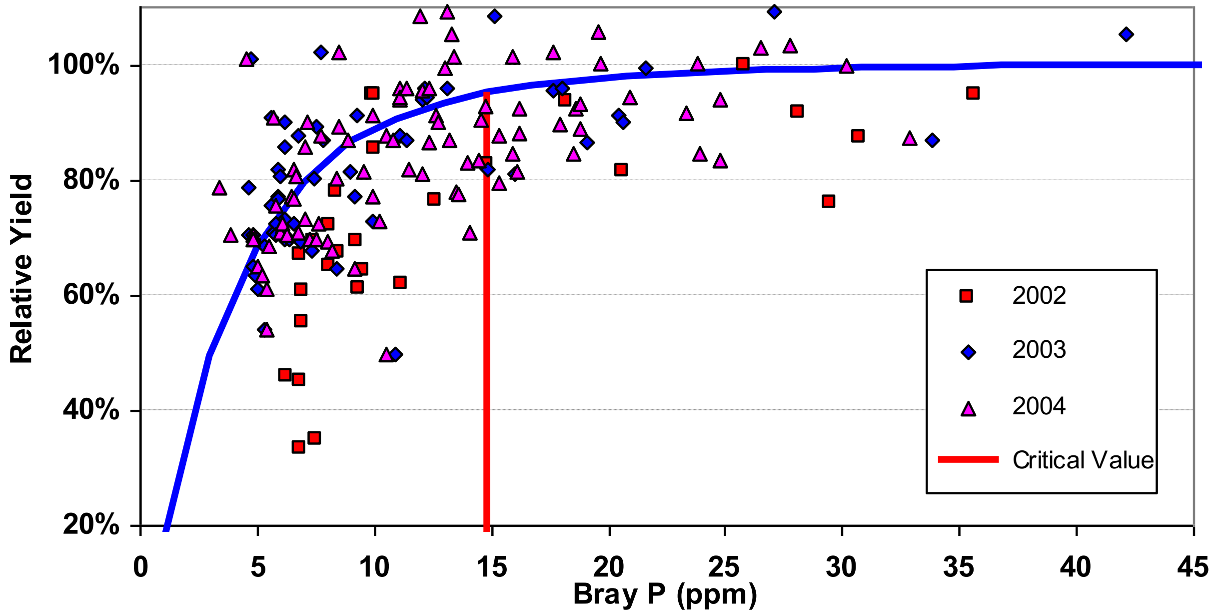
The lowest total error sum of squares (ESS) was used to determine the best-fit model for a particular extractant, and the coefficient of determination (R^2) was subsequently determined. The 'critical value' for each extractant and each individual year was determined by identifying the soil test value at which 95% of maximum yield was obtained in the selected model for each extractant.

RESULTS AND DISCUSSION

The correlation of P soil test values to corn grain yield varied widely for each year. For 2002, r^2 values for the Olsen, Bray, M3-Col and M3-ICP extractants were 0.66, 0.60, 0.55 and 0.60 respectively. For 2003, r^2 values ranged from 0.27 to 0.31 for these extractants. In 2004, r^2 values of 0.33, 0.40, 0.39 and 0.41 were recorded for the Olsen, Bray M3-Col and M3-ICP extractants, respectively. For all soil test extractants/methods, 2003 yielded the least response to increasing soil test value and the lowest P soil test critical values while 2004 was the most responsive year and also resulted in the highest P soil test critical values. After three years, it is impossible to identify what the typical critical soil test valued for any of these extractants might be. If a producer had implemented the results of a single, first year's data, or even two years, he would have been penalized in the third year.

It seems clear that farmer generated research information should be adopted with at least as much caution as more traditional research data. Producers should not too quickly adopt new research findings simply because they were conducted on their own farm. Clearly there is as much variability associated with the collection of a large number of data points from a single field as there is with more traditional research approaches across varying environments and geographies. However, new technologies do provide a means of individual producers easily collecting valuable information from their fields if they are aware of the limitations of this data.

Fig. 1. Corn Yield Relation To Bray Soil Test
KSU-KRV, Average 2002-04



Critial Bray P Soil Test Values For 2002, 2003 and 2004
Shawnee County, KS

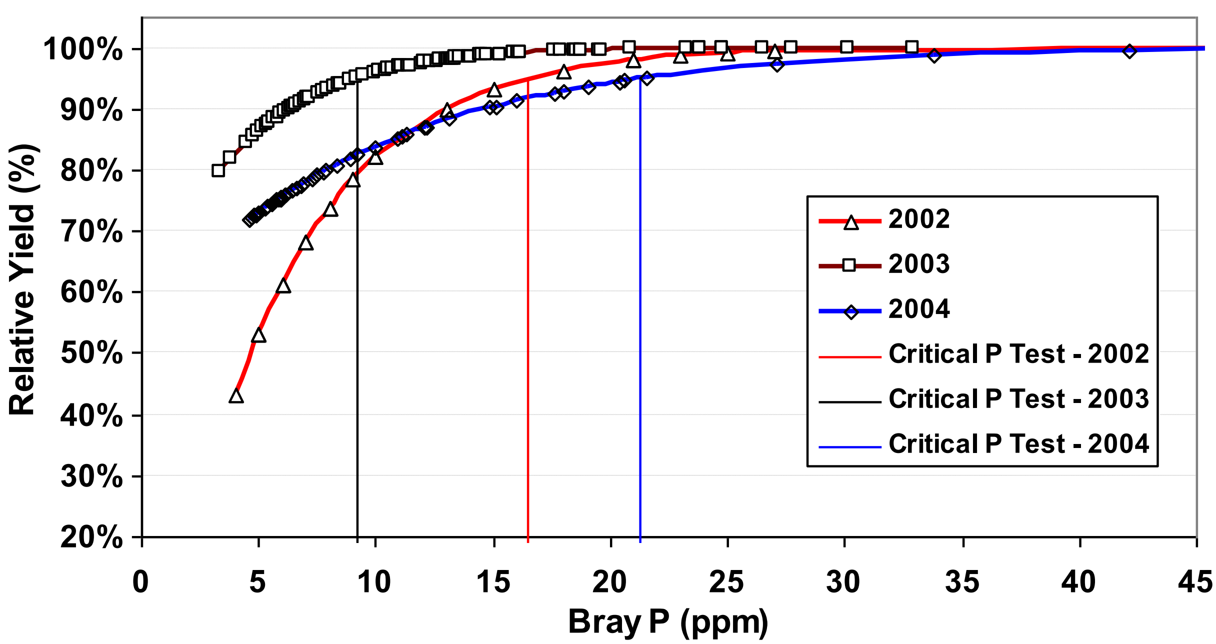
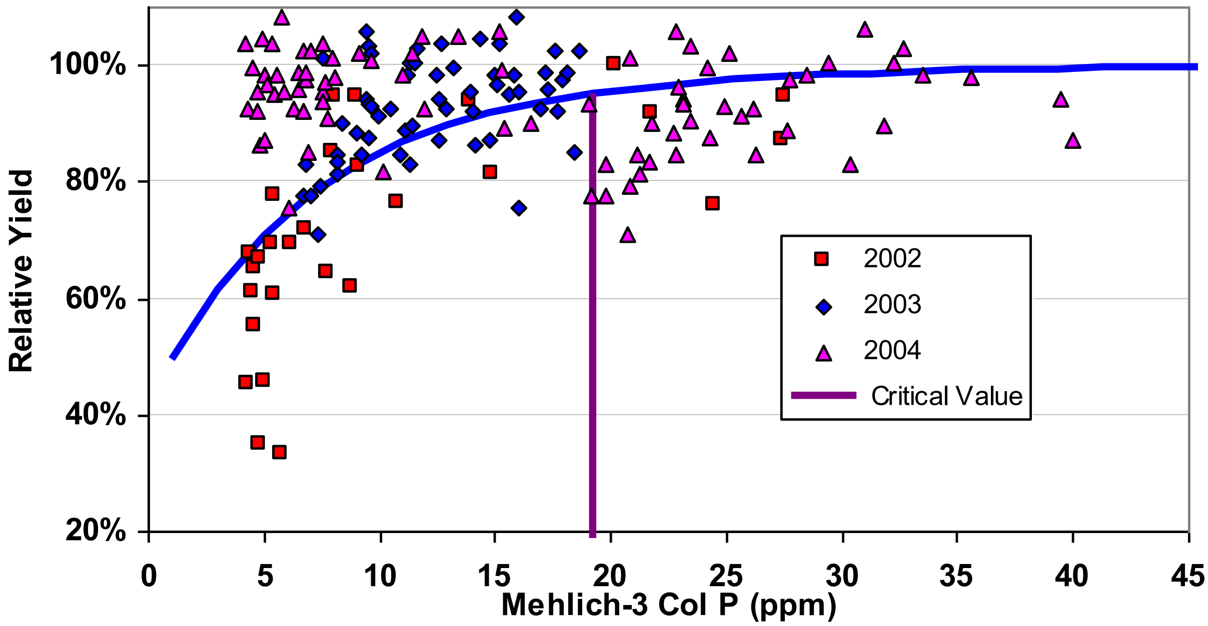


Fig. 2. Corn Yield Relation To M-3 Col Soil Test
KSU-KRV, Average 2002-04



Critial M3-Col P Soil Test Values For 2002, 2003 and 2004
Shawnee County, KS

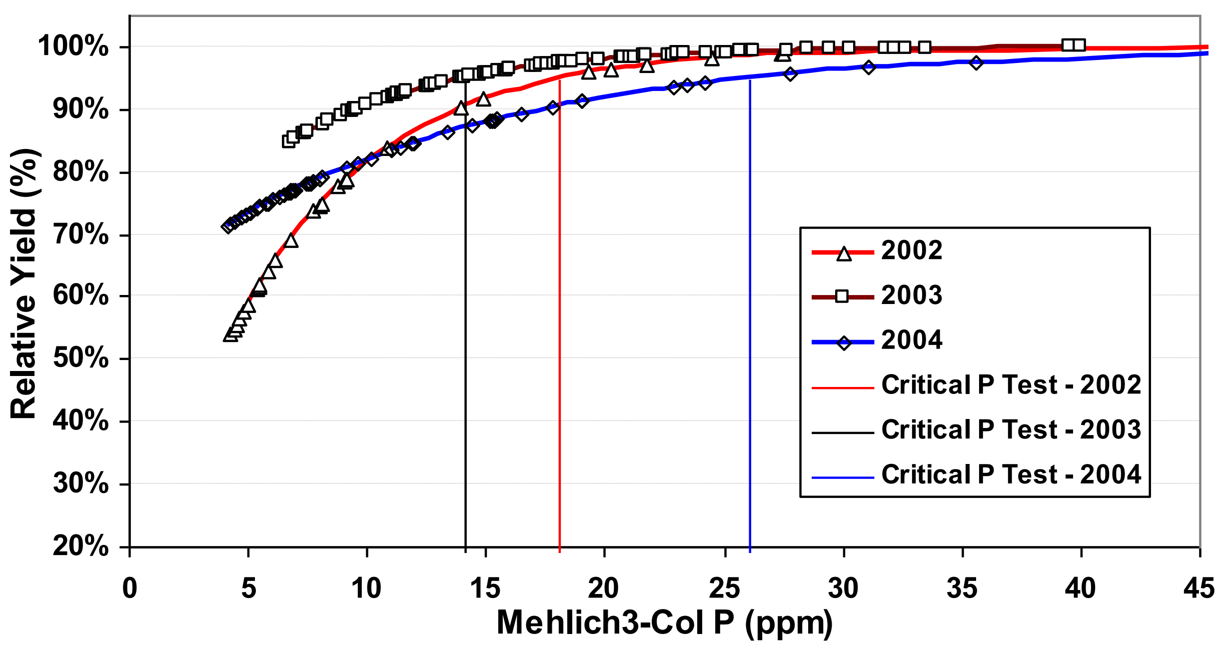
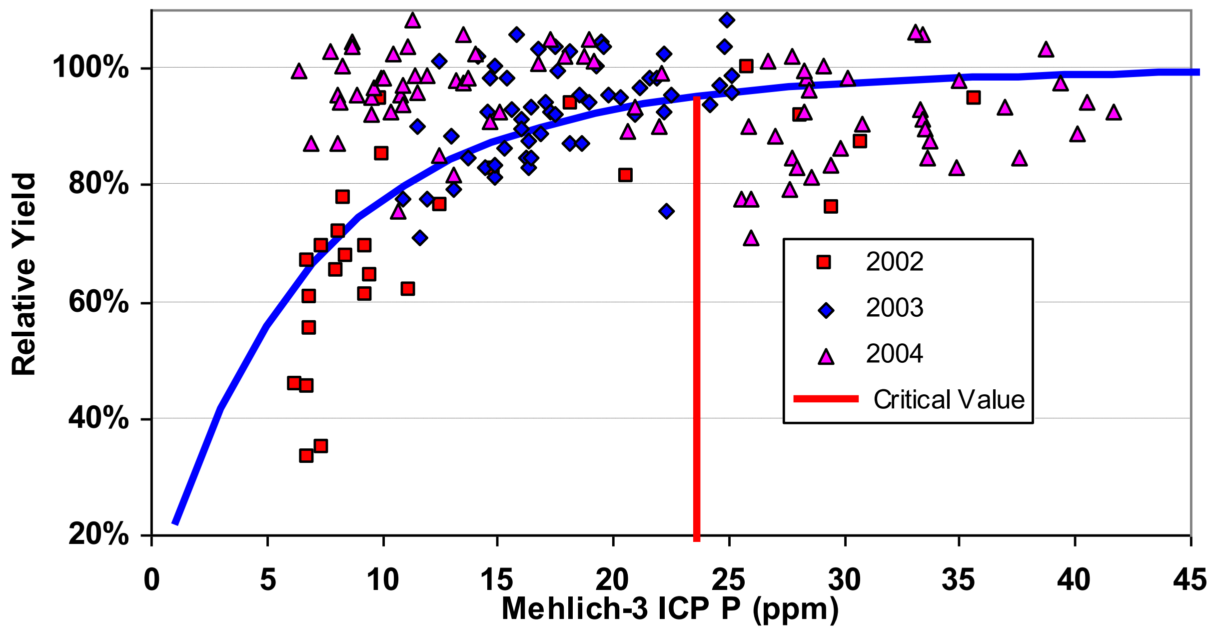


Fig. 3. Corn Yield Relation To M-3 ICP Soil Test

KSU-KRV, Average 2002-04



Critial M3-ICP P Soil Test Values For 2002, 2003 and 2004

Shawnee County, KS

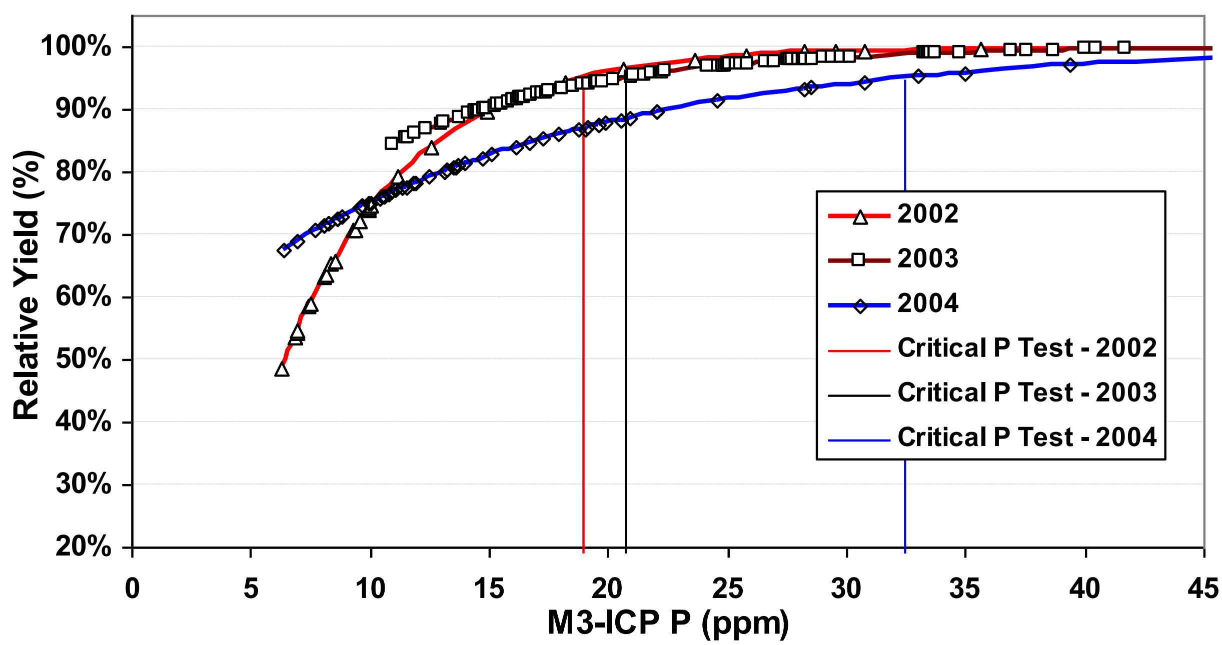
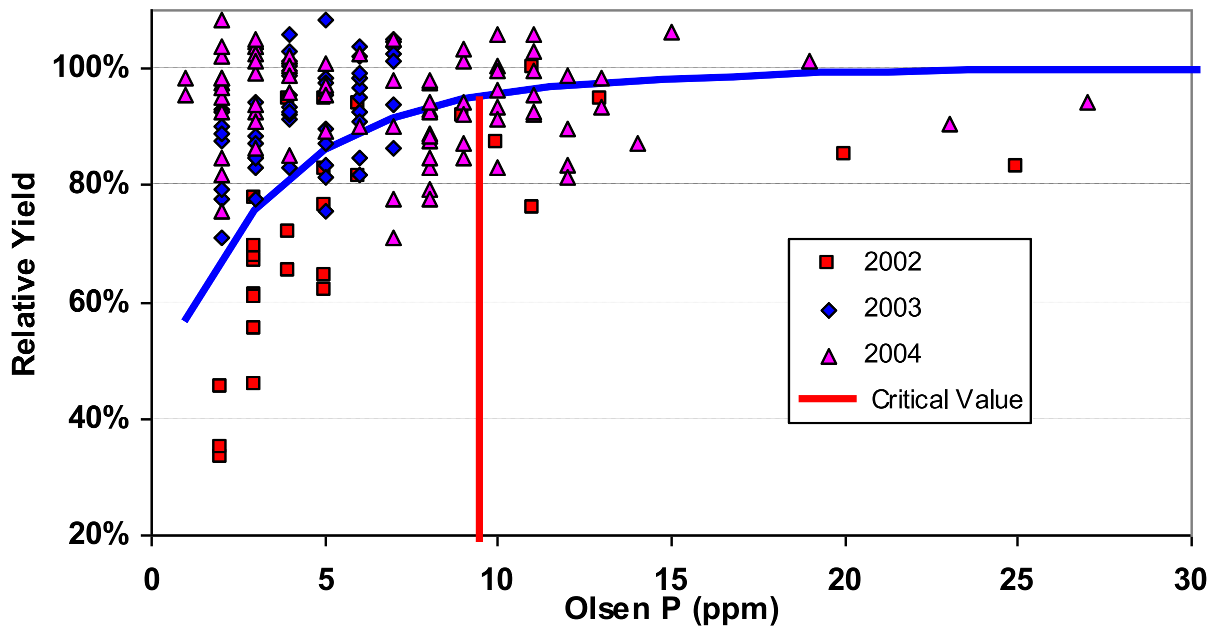


Fig. 4. Corn Yield Relation To Olsen P Soil Test
KSU-KRV, Average 2002-04



Critial Olsen P Soil Test Values For 2002, 2003 and 2004
Shawnee County, KS