

**SIMULATING THE EFFECTS OF NITROGEN AND PHOSPHORUS ON THE
GROWTH AND YIELD OF MAIZE IN VHEMBE DISTRICT, LIMPOPO
PROVINCE**

BY

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ABSTRACT

Maize is the main staple food in South Africa and its production in the country constitute 50 percent of the output in Southern African Development Community (SADC) region. This study was conducted to determine the effect of nitrogen (N) and phosphorus (P) on maize growth and yield and to use the data collected in Agricultural Production Systems Simulator (APSIM) to predict the response of maize to N and P applications as observed in the field. The study was conducted over two seasons, 2005/2006 and 2006/2007. The study evaluated the biomass production, grain yield, plant tissue N and P content and soil N and P content during maize growth. The APSIM model was used to predict biomass and maize yield. Treatments consisted of N fertilizer application at 0 and 75 Kg/ha in 2005/2006 season and 0, 37.5 and 75 Kg/ha in 2006/2007 season as Limestone Ammonium Nitrate (LAN). Phosphorus was applied at 0 and 30 Kg/ha as Single Super Phosphate (SSP) at planting in both seasons. Maize (*Zea mays L*) was the test crop and was planted at a spacing of 90 × 25 cm. Individual plot sizes measured 5m × 4.5m and were laid out in Randomized Complete Block Design with three replications. Biomass was collected at three stages of maize growth, 6-8 weeks after planting, tasseling and at harvest. At maturity, grain was harvested and the yield was determined. Analysis of the variance (ANOVA) using the General Linear Model procedure (GLM) was used to assess the variation of biomass production, grain yield and plant tissue N and P content among treatments. Chi-square test was used to assess the differences between the observed and the predicted biomass and grain yield. The predicted Pearson correlation was used to determine the relationship between soil N at different stages of maize growth and the plant tissue N content and again between soil P at different stages of plant growth and plant tissue P content. There was a significant ($P < 0.05$) difference in maize biomass among plots treated with N and those without N at 6-8 weeks at Univen in both seasons. There was no significant ($P < 0.05$)

biomass amongst all treatments at tasseling and at harvest at both sites and seasons. There was no significant ($P < 0.05$) difference in maize grain yield amongst the treatment plots at both sites and seasons. There was no interaction between N and P in biomass and grain yield at both sites and seasons. There was no significant ($P < 0.05$) difference in plant tissue N and P among the treatments. Plant tissue N was not correlated to soil N at all stages of growth. Plant tissue P was strongly correlated to soil P at different stages of maize growth. The predicted grain yield and biomass yield using APSIM were higher than the observed yield in most treatments. There was a strong relationship between the observed and the predicted biomass yield at 6-8 weeks ($r^2 = 0.940$) and at tasseling ($r^2 = 0.919$) at Univen site in 2005/6 season. There was an agreement between the observed and predicted grain yield at Univen in both seasons ($r^2 = 0.654$ and $r^2 = 0.755$). The chi-square results showed a significant difference between the observed and the predicted biomass and grain yield. Therefore, for APSIM to estimate more acceptable results, the environmental management window should be incorporated.