Nutrition Uptake and Partitioning by Potatoes in Manitoba

John Heard, CCA. Manitoba Agriculture, Food and Rural Initiatives

**Background**

Current interest in determining nutrient balance requires crop advisers to rely on book values to calculate nutrient uptake and removal. Potato nutrient values are often based on studies with greater yield potential than northern growing regions.

This study was initiated to validate the use of such book values and to assess the extent of nutrient uptake from the soil.

**Method**

**Site**

In 2003 a commercially seeded field of potatoes was selected at the Manitoba Crop Diversification Centre at Carberry in central Manitoba. The soil was a Ramada clay loam.

The fall 2002 soil test indicated 46 lb nitrate-N/ac (0-24" depth), 78 lb N/ac in 2-5' depth, 10 ppm Olsen-P = (M), 228 ppm K = (VH), 86 lb S/ac.

**Production**

Ranger Russet potatoes were seeded May 13.

Fertilizer was banded at seeding to supply 60 lb N/ac, 70 lb P₂O₅/ac and 30 lb K₂O/ac with an additional 70 lb N/ac broadcast prior to hilling on June 24.

The crop was irrigated as needed and harvested Oct 7, with a commercial field yield of 288 cwt/ac.

**Sampling**

Plants were sampled 5 times according to critical growth stages (see figures below) in a RCBD sampling pattern with 3 replicates.

Above and below-ground parts were sampled, partitioned, dried, chopped and ground for nutrient analysis by AgVise Labs. Soil was sampled at 3 occasions to a 3' depth for nitrate-N content.

**Results**

**Primary nutrient uptake**

Total N uptake was 177 lb N/ac with 67% in tubers.

- Max rate of N uptake was 4.6 lb N/ac/day between tuber initiation and early bulking.
- N content of potato tops peaked on July 23 at 106 lb N/ac and declined throughout the bulking period at 0.4 - 1.2 lb N/ac/day while tubers accumulated N at 1.5 - 1.9 lb N/ac/day.
- Total P uptake was 69 lb P₂O₅/ac with 86% in tubers.
- Between GS 3-4, plants took up P at a rate of 1.2 lb P₂O₅/ac/day.
- During late bulking, leaves declined in P content while tubers accumulated P at 0.8-0.9 lb P₂O₅/ac/day.
- Total K uptake was 330 lb K₂O/ac with 69% in tubers.
- Between tuber initiation and early bulking, plants accumulated K at 4.6 lb K₂O/ac/day.
- During late bulking leaf tissue declined in K content and tubers accumulated 3.2 lb K₂O/ac/day.
- Uptake of K and Ca occurred at a fairly uniform rate until harvest, indicating requirement for good supply throughout the season.

**Secondary nutrient uptake**

- S uptake was 23 lb s/ac with 63% in tubers.
- S accumulated throughout the season with movement from leaves to tubers during late bulking.
- Maximum Ca uptake was 53 lb Ca/ac and was almost exclusively in leaves (62%) and stem (32%).
- Mg uptake and distribution pattern was similar to Ca, at a maximum uptake of 45 lb Mg/ac with 62% present in leaves and 24% in stems.

**Soil N depletion**

Elevated July nitrate levels reflect the late June N application.

By harvest soil nitrate levels in 0-3' were depleted to < 10 lb N/ac.

**Discussion**

Uptake values were compared to those published by the Canadian Fertilizer institute (CFI) in Table 1.

N uptake values were slightly less than CFI values whereas K, S and Ca uptake and P removal were slightly greater.

In general the published tables are suitable for use by field agronomists.

High yielding potatoes extracted N to depths of 3', while returning 60 lb N/ac in leaf and stem tissue after harvest.

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**References**