



Nutrient Use By Potato Vines and Tubers

Charles G. Painter, Extension Soil Specialist

The quantity of nutrients removed from the soil by potatoes will depend primarily on the yield of vines and tubers grown. Large vines will remove more nutrients than small vines but large vines do not necessarily produce the highest yield of tubers. The amount of nutrients removed by tubers is related to total yield or tonnage grown. The need for commercial fertilizers in production of potatoes will depend primarily on nutrients in the soil available for crop use and the yield of vines and tubers grown. This study determined the quantity of plant nutrients taken from the soil by potato vines and tubers grown under various cultural practices which affected yield.

Procedure

Data for this study were taken from an experiment being conducted to determine the effect of planting dates, seed spacings, nitrogen rates and harvest dates on yield and quality of potatoes in southwestern Idaho. Vines and tubers from the early harvest date were used since vines were still green and few leaves had been lost by that date. Data do not include nutrients in portions of plant below soil surface except tubers.

Vines were removed from 27 individual plots on September 1, just before vine removal for a September 15 harvest date. The vines were cut off at ground level and the green weights for each plot were recorded. A composite sample was taken from each plot and oven dried to determine percent dry matter. Four samples from each treatment were analyzed and the mean for the three closest readings was used for nutrient removal comparison. Tubers were harvested on September 15 and a subsample from each treatment was analyzed for total plant nutrients. Analyses were performed by the University of Idaho Soil Testing Laboratory in Moscow.

Results

The effect of nitrogen rates on yield of potato vines and tubers is shown in Table 1. Since only small variation was found in percent nutrients as affected by nitrogen rates, only the average value of percent nutrients in vines and tubers is given in Table 2. Percentage of all nutrients except phosphorus and copper is higher in the vines than in the tubers.

The amount of nutrients removed from soil by potatoes can be calculated from the average percent of

Table 1. The effect of nitrogen rates on yield of vines and tubers.

| Treatments | Vines | | | Tubers | | |
|----------------|-------------------|-----------------|-------------------------------|-------------------|-----------------|-------------------------------|
| | Field weight | Oven-dry weight | Oven-dry as % of field weight | Field weight | Oven-dry weight | Oven-dry as % of field weight |
| | (pounds per acre) | | (%) | (pounds per acre) | | (%) |
| Nitrogen rates | | | | | | |
| 240 | 41,579 | 4,251 | 10.2 | 52,322 | 10,590 | 20.2 |
| 360 | 44,023 | 4,627 | 10.5 | 48,556 | 9,794 | 20.2 |
| 480 | 46,400 | 5,112 | 11.0 | 48,720 | 9,561 | 19.6 |
| Average | 44,001 | 4,663 | 10.6 | 49,866 | 9,979 | 20.0 |

nutrient in vines and tubers. Table 3 shows the pound of nutrients per acre removed at various yields, based on the average percent nutrient data. Where nitrogen was not a limiting factor in production, vine growth was similar for yields of 300 cwt/acre up to over 600 cwt/acre of tubers. Consequently, the nutrient removal by vines is the same at all tuber yields. Factors affecting yields were planting dates and seed spacings at the September 1 vine removal date. These variables had no great effect on vine weight and nutrient concentrations.

Total nutrients removed by tubers is directly related to yield: 600 cwt/acre required about twice the amount of nutrients as 300 cwt/acre.

The values shown for nutrient removal do not indicate the amount of fertilizer that should be applied, since other factors such as available nutrients in soil and percent recovery of nutrients by plants must be evaluated. Values can be used to show nutritional gains or losses when vines and tubers are returned to soil or removed from the field and which nutrients are more likely to become deficient because of large quantities removed.

Summary

Under the conditions of this experiment where nutrients in soil were sufficient to produce over 600 cwt of tubers per acre, nutrients needed or removed by potato vines were quite similar whether 371 or 633 cwt per acre of tubers were grown. Vine growth was not a

Table 2. Percent nutrients in potato vines and tubers on oven dry weight basis.

| Nutrient | Percent | |
|------------|--------------------|---------------------|
| | Vines ¹ | Tubers ² |
| Nitrogen | 3.08 | 2.14 |
| Phosphorus | 0.21 | 0.29 |
| Potassium | 5.68 | 2.40 |
| Zinc | 0.0024 | 0.0018 |
| Manganese | 0.0032 | 0.0007 |
| Iron | 0.0328 | 0.0132 |
| Copper | 0.0007 | 0.0010 |
| Boron | 0.0026 | 0.0006 |
| Calcium | 0.92 | 0.074 |
| Magnesium | 0.48 | 0.148 |
| Sodium | 0.051 | 0.029 |

¹Average of 27 samples.

²Average of 9 samples.

factor limiting production. Differences in tuber yields were caused by variations in planting date and seed spacing.

Nutrients removed by tubers were directly related to total yield. A 633 cwt/acre yield of tubers will remove from the soil about 400 pounds nitrogen, 47 pounds phosphorus, 596 pounds potassium, 61 pounds calcium, 41 pounds magnesium and small quantities of micronutrients. About 32%, 15% and 49% of the nitrogen, phosphorus and potassium, respectively, are found in the vines.

Table 3. Nutrient removal from soil by potato vines and tubers.

| Nutrient | Nutrients removed, pounds per acre | | | | |
|------------|------------------------------------|----------------------|------|------|------|
| | Vines | Tubers, cwt per acre | | | |
| | | 300 | 400 | 500 | 600 |
| Nitrogen | 139 | 128 | 171 | 214 | 257 |
| Phosphorus | 11 | 17 | 23 | 29 | 35 |
| Potassium | 275 | 144 | 192 | 240 | 288 |
| Calcium | 43 | 4.4 | 5.9 | 7.4 | 8.9 |
| Magnesium | 25 | 8.9 | 11.8 | 14.7 | 17.6 |
| Sodium | 2.70 | 1.74 | 2.32 | 2.90 | 3.48 |
| Zinc | 0.11 | 0.11 | 0.14 | 0.18 | 0.22 |
| Manganese | 0.17 | 0.04 | 0.06 | 0.07 | 0.08 |
| Iron | 2.21 | 0.79 | 1.06 | 1.32 | 1.58 |
| Copper | 0.03 | 0.06 | 0.08 | 0.10 | 0.12 |
| Boron | 0.14 | 0.04 | 0.05 | 0.06 | 0.07 |