PHOSPHORUS AND COMPOST ON IRRIGATED POTATO CROPS

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ABSTRACT

Alberta's intensive livestock operations produce large amounts of manure. When managed appropriately, manure is a natural fertilizer source, which can provide both macro and micronutrients as well as organic matter to the soil. Recently, feedlot manure has been composted in order to kill weed seeds and to remove water, thereby concentrating nutrients, decreasing shipping costs and creating a value-added product. Between 1999 and 2001, field-scale research was conducted into the effectiveness of various rates of composted manure, as a spring applied phosphorus (P) source for irrigated potatoes, as compared to various rates of mineral P fertilizer. Phosphorus fertilizer and compost treatments were surface applied on strips within irrigated potato crops. Total plot sizes ranged from 12 to 23 acres, with 8 to 11 treatments. Each year, on each field, petiole (plant tissue) samples were collected at three dates. Potato samples were gathered and the tubers were graded by size and assessed for specific gravity and disease. Increased inputs of P gave increased levels of petiole P for both mineral fertilizer and compost, yet, there were no consistent effects on yield. The effects of fertilizer P and compost on petiole P, yield, disease and specific gravity of potatoes will be presented.

INTRODUCTION

Alberta's intensive livestock operations produce large amounts of manure. If managed appropriately, manure is a natural fertilizer source, which can provide both macro and micronutrients as well as organic matter to the soil. Recently, feedlot manure has been composted in order to kill weed seeds and to remove water, thereby concentrating nutrients, decreasing shipping costs and creating a value-added product.

The Soil and Water Agronomy Program at the Crop Diversification Centre, South has been conducting annual research projects into the effectiveness of composted cattle manure as a spring applied phosphorus (P) fertilizer source for irrigated potatoes, as compared to rates of a mineral phosphorus (P) fertilizer. These experiments were conducted at a field scale, on eight fields between 1999 and 2001. The objectives of the project were

(1) to examine the effect of rates of P fertilizer on yield and quality of potatoes;
(2) to compare manure and composted manure to mineral P fertilizer;
(3) to determine the impacts of compost on the occurrence of diseases in potato plants and tubers; and
(4) to determine the suitability of current tissue analysis of potato petioles for P.

MATERIALS AND METHODS

Field-scale experiments were conducted at a total of eight potato fields. Locations included Brooks (1999), Hays (1999), Vauxhall (1999), Barnwell (2000 and 2001), Cranford (2000 and 2001) and Fincastle (2000). Each year, a variety of spring-applied phosphorus fertilizer and compost treatments were surface applied on strips within irrigated potato crops. Mineral fertilizer N was added to most treatments to ensure equivalent amounts of total N were applied to each treatment. Total plot sizes ranged from 12 to 23 acres, with 8 to 11 treatments and 4 reps within each of the plots. Each year, petiole samples were collected at three dates. In 2000, plant disease was assessed in the field. Each year, tuber samples were gathered and they were graded by size and assessed for specific gravity and disease.

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RESULTS

Results from five of the eight sites are given (Fig. 1-3). Each figure indicates the amounts of fertilizer and compost P added to each treatment, in the table at the top. The bar graphs below that indicate the corresponding petiole P, tuber yield, specific gravity and tuber *Rhizoctonia*. The recommended % petiole P, for the three sampling dates are given in Table 1.

Table 1. Petiole P Standards from NW USA.

Time of Year	Adequate Range
Early July	0.22-0.62%
Late July	0.20-0.50%
Mid August	0.16-0.40%

Petiole results usually fell within these ranges, with the lower rates of fertilizer P sometimes falling below minimum suggested requirements. There was no significant effect on yield. One exception is the 2000 Fincastle Site (Fig. 2) where yields for the compost treatments were higher overall than for mineral fertilizer treatments. At this site, all compost treatments also received full amounts of mineral fertilizer (N, P and K). Specific gravities were not significantly affected by P treatments, however, tubers from the sites at Barnwell (2000, 2001) and Fincastle (2000) showed slightly lower specific gravity values on treatments where compost was added.

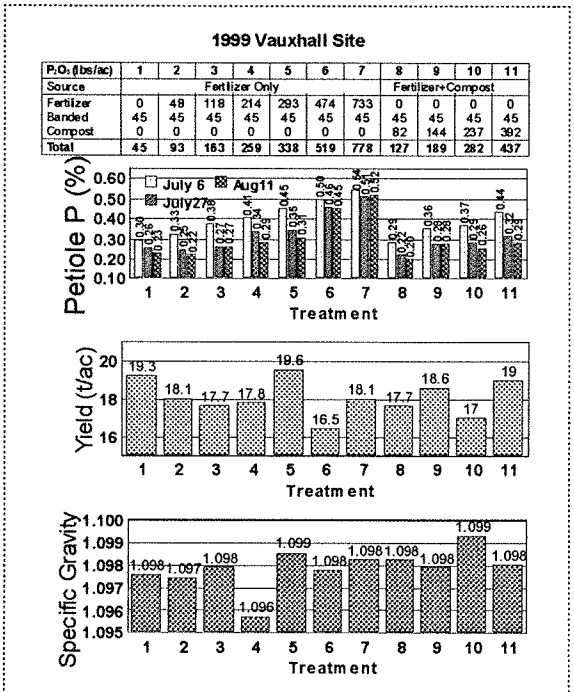

Fig. 1. Summary of phosphorus fertilizer rates, petiole phosphorus, tuber yield and specific gravity of potatoes, Vauxhall 1999.

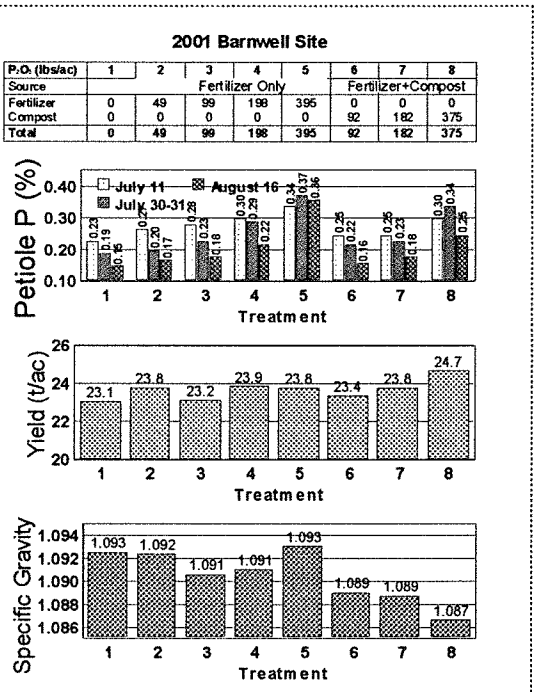

Fig. 3. Summary of phosphorus fertilizer rates, petiole phosphorus, tuber yield and specific gravity of potatoes, Barnwell 2001.

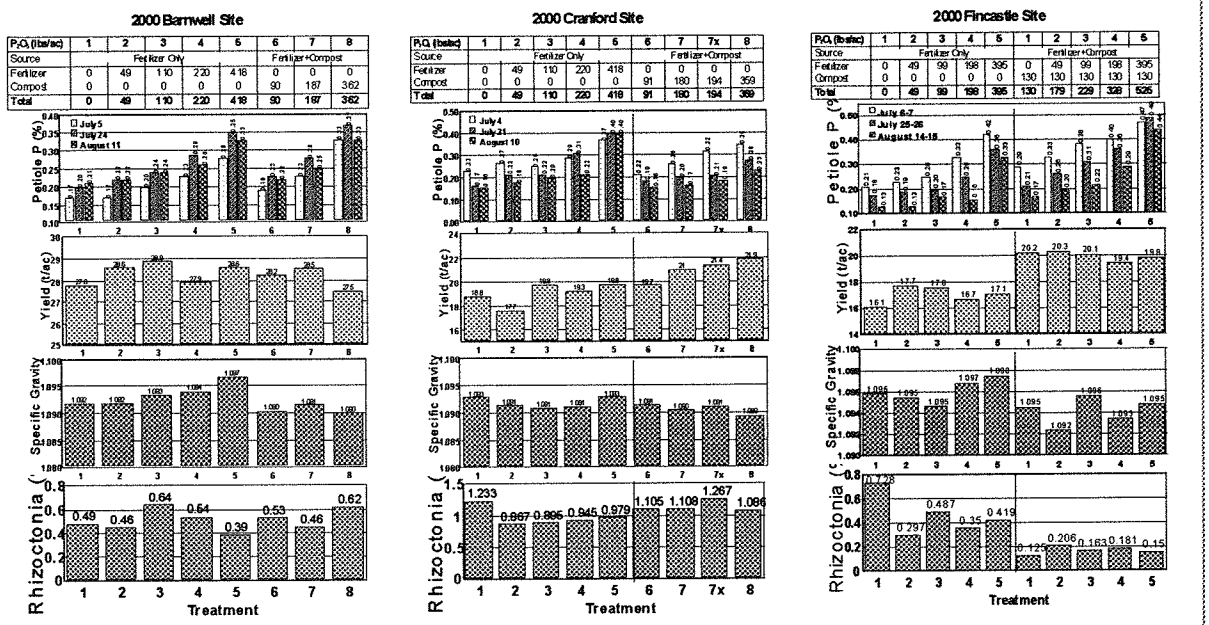

Fig. 2. Summary of phosphorus fertilizer rates, petiole phosphorus, tuber yield, specific gravity and tuber *Rhizoctonia* of potatoes, 2000.

CONCLUSIONS

Results indicate that increased inputs of P gave increased levels of petiole P for both mineral fertilizer and compost. These results indicate that the P in the compost was immediately plant-available, even in early July. Despite increases in petiole P, there were no discernible effects on yield, calling into question current fertilizer and petiole P recommendations. Compost had no negative impacts on plant or tuber disease and was associated with a lower incidence of *Rhizoctonia* at Fincastle in 2000. Compost had a small effect on specific gravity values, in some instances decreasing it slightly. Compost is a good source of P and K. When combined with mineral N fertilizer, it has potential for improving potato yields.

ACKNOWLEDGEMENTS

Alberta Potato Research Inc., McCains Foods, Westco, Potash and Phosphate Institute of Canada and the Potato Agronomy Program at CDC South provided funds to make this project possible. Materials and equipment were provided by Agricore, Agrium, Lakeside Fertilizer, Southern Agri Services and the Agricultural Technology Center.

The authors would like to gratefully acknowledge the co-operating potato producers who allowed experiments to be conducted on their fields. These include C. Bydevaate, J. Miyanaga, C. Perry, J. Rozendaal and K. Sikkens. Field assessments of plant disease were conducted by P. Baines, D. Fujimoto and S. Mathur. Potato tuber disease was assessed by H. Harms and L. Wenger, with training provided by J. Holley. Specific gravity measurements were done by D. Thiessen and L. Wenger. Numerous people assisted with gathering petiole samples, including AAFRD Irrigation staff from Taber and Brooks offices, as well as staff from the Potato Agronomy program, CDC South.