# Potash Fertilizer on Potatoes

## yields of field-run White Rose potatoes increased materially by potash treatments in fertilizer trials in Madera County

Clarence E. Johnson

**Out of 11 trials** completed over a nine-year period, significant responses—increases as high as 31%—have been obtained from five out of six trials on Ripperdan soils. In the sixth trial on Ripperdan soil and in one trial out of three on Hanford soils, the response was only slightly below the degree of significance. No response was obtained in one trial each on a Ripperdan-Dinuba soil and on a Grangeville soil.

In two of the trials on Ripperdan soils, the complete treatment of nitrogen-phosphorus-potassium—NPK—was significantly better than the nitrogen-phosphorus—NP—treatment. In two of the other trials, the response to potash was only slightly below the degree of significance.

The outstanding response to potash on Ripperdan soils was the basis for further fertilizer testing with potassium on the same soils.

A leaf analysis survey was used as a basis for selecting areas for further field testing. The soil was considered to be deficient if the mid-season concentration of potassium in the leaf was less than 7.01%. The supply of available potassium was classed as low when the leaf concentration was between 7.01% and 9.00%; medium, between 9.01% and 11.00%; and high, when above 11.01%.

Leaf samples were taken from eight fields on Ripperdan soils, and from four fields on Hanford and Grangeville soils at mid-season. The survey indicated that many potato areas in Madera County are low in potassium, with 93% of fields on Ripperdan series, and 54% of fields on Hanford and Grangeville series, showing deficient to low mid-season leaf levels.

Without exception, severe, to very severe, leaf scorching occurred before harvest in all fields that had a mid-season leaf content less than 7.00% potassium. Slight to moderate scorching before harvest was observed in some fields that had a mid-season leaf content in the 7.01%–9.00% range.

Soil tests—on samples taken from the same locations as the leaf samples—showed that the potassium in the soil was directly correlated with leaf potassium. The deficient-to-low range in leaf potassium corresponded with a soil potassium level of 40–80 ppm—parts per million—replaceable potassium.

Based on the leaf and soil analyses, three locations were selected for test plots where potatoes could be expected to respond to potassium fertilizer and two locations where it seemed that no response was likely.

Broadcast and side-dress treatments were applied on two plots with sulfate of potash as the source of potassium. On three plots, side-dress treatments only were placed 6½" to each side of the rows, and about 1" below the seed piece immediately after planting. At each of the locations the grower applied a fertilizer treatment—which in no case included potassium—at planting.

In all trials the plots were approximately a quarter of a mile long and 4–8 rows in width, depending on the growers' harvesting methods. All treatments were replicated either three or four times.

**Potassium Range in Potato Leaf Analysis Survey in Madera County**

| Soil type | Samples | Deficient less than 7.01% | Low 7.01% to 9.00% | Medium 9.01% to 11.00 % | High more than 11.01 % |
|---|---|---|---|---|---|
| Ripperdan | 30 | 80.0 | 13.0 | 7.0 | 0 |
| Hanford and Grangeville | 24 | 33.5 | 21.0 | 45.5 | 0 |
| Average | | 59.5% | 16.5% | 24.0% | 0 |

**Summary of Leaf and Soil Analyses**
**Data and yields for Madera County potato trials**

| Treatment potassium oxide lbs. | Soil potassium ppm | Percent leaf potassium, Sample dates: May 9 | May 31 | June 20 | June 30 | Yield: Cwt/acre | % of check |
|---|---|---|---|---|---|---|---|
| *Trial 1-55* | | | | | | | |
| 0 | 49 | 9.51 | 3.97 | 0.96 | 0.74 | 288 | 100 |
| 100 SD[1] | | 11.17 | 6.80 | 2.04 | 1.70 | 329 | 114 |
| 200 SD | | 11.10 | 7.80 | 3.19 | 3.45 | 336 | 117 |
| 200 B[2] | | 11.37 | 7.37 | 3.17 | 2.02 | 331 | 115 |
| 400 B | | 11.85 | 9.45 | 5.12 | 4.71 | 358 | 124 |
| | | | | | LSD[3]—5% level | 30 | |
| | | | | | LSD—1% level | 43 | |
| *Trial 2-55* | | | | | | | |
| 0 | 64 | 8.63 | 4.19 | 1.31 | 1.05 | 243 | 100 |
| 100 SD[1] | | 9.57 | 6.35 | 3.02 | 2.33 | 282 | 116 |
| 200 SD | | 9.68 | 7.72 | 5.08 | 2.91 | 303 | 125 |
| 200 B[2] | | 10.43 | 7.20 | 3.06 | 2.52 | 297 | 124 |
| 400 B | | 10.73 | 9.15 | 5.71 | 4.38 | 302 | 125 |
| | | | | | LSD—5% | 17 | |
| | | | | | LSD—1% | 24 | |
| *Trial 3-55* | | | | | | | |
| 0 | 58 | 10.24 | 3.04 | 0.79 | 1.07 | 327 | 100 |
| 100 SD[1] | | 11.95 | 4.77 | 2.05 | 2.56 | 325 | 99 |
| 200 SD | | 12.18 | 5.86 | 3.47 | 3.47 | 339 | 104 |
| | | | | | LSD—5% | NS[4] | |
| | | | | | LSD—1% | NS | |
| *Trial 4-55* | | | | | | | |
| 0 | 98 | 10.97 | 6.17 | 3.66 | 3.82 | 255 | 100 |
| 100 SD[1] | | 10.65 | 7.37 | 5.20 | 4.68 | 255 | 100 |
| 200 SD | | 11.00 | 7.96 | 5.84 | 5.26 | 255 | 100 |
| | | | | | LSD—5% | NS | |
| | | | | | LSD—1% | NS | |
| | | Sample dates: May 2 | May 23 | June 9 | June 23 | | |
| *Trial 1-56* | | | | | | | |
| 0 | 57 | 6.74 | 4.23 | 0.94 | 0.74 | 276 | 100 |
| 100 SD[1] | | 8.21 | 6.61 | 1.66 | 1.29 | 326 | 118 |
| 200 SD | | 8.71 | 7.88 | 2.65 | 2.08 | 338 | 122 |
| 250 SD | | 8.97 | 8.49 | 3.62 | 3.09 | 362 | 131 |
| 300 SD | | 9.11 | 9.31 | 4.38 | 3.65 | 354 | 128 |
| | | | | | LSD—5% | 39 | |
| | | | | | LSD—1% | 54 | |

[1] SD—Side dress treatments.
[2] B—Broadcast treatments.
[3] LSD—Least significant difference.
[4] NS—Not significant.

**Hooded** *left* **and normal awned Atlas barleys.**

# Hooded Atlas Barley

## studies indicate development of hooded barley competitive with awned doubtful

**Coit A. Suneson and Burt J. Hoyle**

**Dual-purpose** — hay and grain — Hooded Atlas barley was created from a lineage of about 5,000 plants grown during an 18-year period.

Hoods—trifurcate awns—are relatively soft structures and give the heads a distinctive beardless appearance.

Barleys with this character are found principally in the high Himalaya valleys of Asia. In America hooded introductions and their hybrids have been comparatively unproductive. Their best performance has been in western states at high elevations. Most of this acreage is cut for hay.

To produce Hooded Atlas, selected plants were backcrossed for 10 generations and then 103 selected lines were blended. This procedure resulted in two almost identical forms, near isogenic except that one was hooded and the other was awned—bearded. With these, a precise study of the effects of the hooded character could be made.

In 60 paired tests of Atlas and Hooded Atlas—made at Davis from 1953 to 1957—Atlas had a mean yield of 2,813 pounds of grain per acre and Hooded Atlas produced 24% less grain. All three of the components of yield—heads per unit area, grains per head, and individual grain weight—were lower for Hooded Atlas. The reduction in kernel weight accounted for 56% of the decreased yield. Furthermore, the kernels from Hooded Atlas were less symmetrical and required 8% more bin space to store a given tonnage.

In 45 comparisons at the Tulelake Field Station, Atlas produced 5,568 pounds of grain per acre, and Hooded Atlas produced 13% less. The lessened disparity between the yields of the two types at Davis and at the higher elevation of Tulelake was statistically significant.

Lower yield was not the only economically undesirable trait observed in Hooded Atlas. Structurally the hood facilitated entry inside the hulls of floral infecting disease spores of the barley stripe and loose smut fungi, thus increasing the severity of these seedborne diseases. Also such foliar diseases as net blotch or scald were found to develop on and discolor—brown spot—the hulls of Hooded Atlas much more commonly than those of Atlas.

These studies show that a hooded Atlas barley competitive with awned barley in grain yield and quality probably can not be produced for any of the important barley producing areas in California.

The studies also illuminate two obscure features of plant breeding. Multiple action by a gene, called pleiotropy, which conditions changes in form, production and quality, is seldom encountered. Likewise a gene-environment interaction involving the effect of altitude is unusual.

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These trials were designated as *1-55*, *2-55*, *3-55* and *4-55*. One plot was not carried through to completion. The following year, three field plot locations were selected for further trials. Only one of these was completed and designated as *1-56*.

In Trial *1-55*, the soil type was Ripperdan fine sandy loam, where the previous two crops were cotton. Severe leaf scorch became evident several weeks before harvest on the check plots. Later, leaf scorch became severe on the plots receiving the lower rates of potash.

Trial *2-55* was on the same soil type as *1-55*, with previous crops of potatoes and barley. Deficiency symptoms developed at the same time and under the same circumstances as in *1-55*.

Trial *3-55* was on a Grangeville fine sandy loam that had a history of potato production in three of the previous four years. The soil potassium level was low, and the leaf potassium reached a low level comparable to Trials *1-55* and *2-55*. In contrast to the two trials on Ripperdan soil, the response to potash was not significant in Trial *3-55*. The expected response to potassium was not obtained, probably due to soil conditions peculiar to the location, or factors more limiting to production than the level of potassium.

The soil type in Trial *4-55* was Ripperdan-Dinuba fine sandy loam located on the westerly edge of the Ripperdan soil area. The addition of potash raised the potassium leaf content in the treated plots, but there was no increase in yield. The soil content was in the mid-high range and no potassium deficiency leaf symptoms were observed.

In Trial *1-56*, the soil type was Ripperdan fine sandy loam, centrally located in the Ripperdan soil area. Soil tests indicated a level of 57 ppm replaceable potassium. Severe leaf scorching was observed in the check and low potash plots prior to harvest. Although there were marked responses to potash at this location, the nitrate-nitrogen leaf levels reached the low range in all plots early in the season. Had this nitrogen requirement been met, there is a good possibility that yields realized would have been higher.

In these trials, differences between broadcast and side-dress fertilizer treatments were not significant. A rate of 200 pounds potassium oxide per acre appeared to be the best rate under the conditions of the trials. Leaf analysis suggested, however, that the optimum level of potassium in the plant was not being maintained from mid-season to harvest in the low potash areas, even where 400 pounds potassium oxide per acre was applied.

*Forrest Fullmer of the American Potash Institute assisted in the above studies.*

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