# Potato Fertility Experiments

The potato fertility experiment for 1967 consisted of three locations:

1 - Eugene Frederick farm 1½ miles west of Terrebonne
2 - A. E. Albertsen farm 4 miles south of Powell Butte
3 - Madras site of the Central Oregon Experiment Station

The Frederick and Albertsen locations contained similar treatments and were designed to give information on the following points:

1. Rate of phosphate application necessary for optimum yields of potatoes.

2. The most effective method of application of potassium fertilizer with additional information on rate of application.

3. The interaction of rates of N, P and K as measured by yield and nutrient uptake by the plants.

The Madras location was established to obtain information primarily on rates and interaction of rates of N and $P_2O_5$ and the effect of method of application of P.

To evaluate the above effects, the following data was collected:

Yield of tubers in tons per acre
Specific gravity of the tubers
Market grade
Plant analysis of petioles per P, K, Ca, Mg, Fe, Mn and Zn.

## Eugene Frederick Farm

Soil type: Deschutes Sandy loam (over cinders)
3--7% slope

Irrigation: Sprinkler

Soil test: 5/12/67

| | | |
|---|---|---|
| K #/A | 390 | Range 328 - 490 |
| P #/A | 23.4 | Range 20 - 32 |
| Ca me/100 gms | 4.85 | |
| Mg me/100 gms | 3.41 | |
| pH | 5.9 | |

Broadcast applications (plow down) applied 5/12/67
Planted May 24, 1967
Harvested Oct. 14, 1967
Plant samples taken July 19, 1967 (middle to late bud stage)
57 days after planting

Application of Fertilizers:

All nitrogen banded two inches to the side and below seed piece.
Phosphate was all banded except for one treatment 80/80 in which 80# was banded and 80# plowed down
Potassium was banded (2x2) at planting time and plowed down, applied after plowing and disced into the soil, part banded 75/ and part plowed down /75
30 #/A Zinc sulphate was banded in all treatments, except the two noted in the table.

Culture:

The stand was not exceptional at this location and the presence of volunteer potatoes added to the lack of uniformity of stand.

Because of the above normal summer temperatures over an extended period of time, the farmer encountered difficulty in getting water to the experimental plot often enough. This fact lowered yield appreciably and probably depressed the fertilizer effect, as a consequence only a few significant differences appear even though the experiment had a good Coefficient of Variation. The lack of water also reduced the percentage of No. 1 potatoes by 20 - 25% of the grade which would normally be expected from sprinkler irrigated potatoes.

Results:

Observations indicated that 150# pound of N was probably insufficient for optimum yield during the long growing season of 1967.

Considering phosphate and potassium, phosphate was the more limiting nutrient and at the 150# N level 160 pounds of $P_2O_5$ was required to supply the minimum needs of the plant. Using .35% total P in the petiole as the critical level for the early season sampling, then even 160# $P_2O_5$ was not always sufficient. One point to be carefully watched in the future is the effect of applying very high rates of phosphate in the band in Central Oregon soils. The 240# rate appeared to depress yields in comparison to the 160# treatments. It is conceivable that in these poorly buffered soils the band and area immediately around the band become too acid for the plant to take advantage of the fertilizer. When N and P were applied without K at this low K location, the plants became K deficient even at low P application rates.

The split application of phosphate 80# banded 80# plowed down resulted in about the same P uptake as 80 pounds banded. The potassium variable in this comparison confuses the uptake picture.

Under the conditions of this year, there appeared to be little effect from the method of application of potassium. The 450# K rate banded produced a salting effect and the plants were definitely affected by this toxic effect. The yield differences between the 225 and 450 pound rate were practically nil, however, with the yield levels limited by moisture, it is possible that the 225# rate was sufficient. The petiole analysis confirms this although if the 9% K content is considered the critical level for this date of sampling then even during the limiting conditions of this year the needs were barely met.

The zinc levels in the leaf indicate adequate zinc levels without the addition of zinc, consequently in Table No. 1 the no zinc treatment were averaged with the zinc treatment.

Table No. 2 shows the average values for yield, market grade and specific gravity. The market grade reflects the water shortage and, while significant values were obtained, they are generally in reverse order of what would be expected. Those treatments with the greatest yield potential due to fertilization had the poorest grade.

The specific gravity results reflect the facts that phosphate fertilizers tend to increase specific gravity and potassium, at least as KCl, decreases specific gravity.

Table No. 1 presents the average results obtained by the chemical analysis of the petiole or leaf. The effect of P, K, and Zn was reported above. The Magnesium level was not particularly high for Central Oregon but still demonstrated the expected inverse uptake relationship with potassium.

Appendix Tables No. 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 present the yield, grade, specific gravity, P, K, Ca, Mg, Zn, Mn and Fe data by replicate.

Table No. 1

The Effect of Nitrogen, Phosphate and Potassium Treatments on the Uptake of Phosphorus, Potassium, Calcium, Magnesium, Zinc, Manganese and Iron in the Petioles of Russet Burbank Potatoes Grown on the Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | Average Yield | Petiole Content | | | | Leaf Content | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | Tons/Acre | P % | K % | Mg % | Ca % | Zn PPM | Mn PPM | Fe PPM |
| 150 | 0 | 0 | 10.04 | .20 | 10.10 | .94 | .99 | 45 | 63 | 250 |
| 150 | 80 | 0 | 13.03 | .30 | 8.25 | 1.26 | 1.10 | 52 | 81 | |
| 150 | 160 | 0 | 13.29 | .36 | 8.25 | 1.24 | 1.10 | 37 | 65 | 155 |
| 150 | 160 | 0 (1) | 14.43 | .33 | 7.15 | 1.44 | 1.15 | 27 | 75 | 164 |
| 150 | 240 | 0 | 12.00 | .40 | 6.63 | 1.53 | 1.17 | 28 | 72 | |
| 150 | 0 | 75/150 | 9.60 | .22 | 10.63 | .80 | .93 | 52 | 111 | |
| 150 | 160 | 75 (2x2) | 13.00 | .38 | 9.05 | 1.24 | 1.06 | 53 | 119 | |
| 150 | 160 | 225 (2x2) | 13.87 | .31 | 10.45 | 1.02 | 1.07 | 71 | 168 | |
| 150 | 160 | 450 (2x2) | 13.58 | .29 | 9.95 | .93 | 1.02 | 52 | 133 | |
| 150 | 160 | 225 disc | 12.76 | .34 | 10.10 | 1.09 | 1.12 | 57 | 146 | |
| 150 | 160 | 450 disc | 12.64 | .33 | 11.05 | .92 | 1.07 | 46 | 105 | |
| 150 | 160 | 225 plow | 12.44 | .33 | 9.68 | .97 | 1.02 | 34 | 88 | |
| 150 | 160 | 450 plow | 15.00 | .37 | 10.35 | .91 | 1.07 | 49 | 125 | |
| 150 | 160 | 75/150 | 14.25 | .34 | 10.75 | .81 | .96 | 51 | 114 | 187 |
| 150 | 160 | 75/375 | 12.32 | .35 | 11.00 | .84 | .97 | 54 | 120 | 168 |
| 150 | 160 | 75/375(1) | 14.37 | .35 | 10.90 | .70 | .90 | 32 | 78 | |
| 150 | 80/80 | 75/375 | 14.04 | .32 | 10.90 | .81 | .92 | 55 | 104 | |
| 250 | 160 | 75/375 | 15.53 | .38 | 11.25 | .69 | .82 | 66 | 132 | 201 |
| 250 | 240 | 75/375 | 13.80 | .33 | 10.25 | .82 | .94 | 49 | 98 | 180 |

(1) No Zinc - remainder of treatments received 30#/A Zn $SO_4$

Table No. 2

The Effect of Rates of Nitrogen, Phosphate and Potassium and Method of Placement of Phosphorus and Potassium Fertilizers on Yield, Market Grade and Specific Gravity of Russet Burbank Potatoes Grown on

Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | Average Yield | Market Grade Percentage | | | Specific |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | Tons/Acre | No. 1 | No. 2 | Culls | Gravity |
| 150 | 0 | 0 | 10.04 | 45.87 | 29.20 | 24.96 | 1.076 |
| 150 | 80 | 0 | 13.03 | 45.59 | 31.12 | 23.30 | 1.080 |
| 150(1) | 160 | 0 | 13.86 | 52.07 | 28.28 | 23.05 | 1.082 |
| 150 | 240 | 0 | 12.00 | 51.07 | 26.34 | 22.60 | 1.084 |
| 150 | 0 | 75/150(4) | 9.60 | 45.64 | 27.24 | 27.14 | 1.074 |
| 150 | 160 | 75(2x2)(3) | 13.00 | 44.73 | 31.68 | 23.60 | 1.080 |
| 150 | 160 | 225(2x2) | 13.87 | 46.13 | 35.24 | 18.62 | 1.079 |
| 150 | 160 | 450(2x2) | 13.58 | 40.69 | 33.98 | 25.34 | 1.075 |
| 150 | 160 | 225 disc | 12.76 | 40.03 | 30.54 | 29.44 | 1.078 |
| 150 | 160 | 450 disc | 12.62 | 37.75 | 28.50 | 33.76 | 1.075 |
| 150 | 160 | 225 plow | 12.44 | 39.75 | 31.02 | 29.26 | 1.078 |
| 150 | 160 | 450 plow | 15.00 | 43.00 | 32.52 | 24.50 | 1.078 |
| 150(1) | 160 | 75/150 | 14.251 | 38.75 | 33.64 | 25.63 | 1.078 |
| 150(1) | 160 | 75/375 | 13.34 | 42.75 | 25.00 | 32.25 | 1.074 |
| 150 | 80/80(2) | 75/375 | 14.04 | 41.50 | 33.76 | 24.76 | 1.074 |
| 250 | 160 | 75/375 | 15.53 | 44.50 | 32.02 | 23.50 | 1.076 |
| 250 | 240 | 75/375 | 13.80 | 32.50 | 36.26 | 31.26 | 1.077 |
| | | L.S.D. @ 5% | 2.19 | 11.13 | | | .003 |
| | | C.V % | 11.75 | 18.2 | | | .21 |

(1) Average of two treatments
(2) 80# $P_2O_5$ in band and 80# $P_2O_5$ plow down
(3) Banded 2 inches below and to side of tuber
(4) 75# banded 2x2 150 plowed down

A. E. Albertson Farm

Approximately four miles south of Powell Butte Post Office.

Soil type: Deschutes Sandy loam

Irrigation: Surface irrigation between rows

Soil test:

| | | |
|---|---|---|
| pH | 6.1 | |
| P #/A | 42.2 | Range 36 - 60 |
| K #/A | 530 | Range 398 - 733 |
| Ca me/100 gms | 5.3 | |
| Mg me/100 gms | 3.5 | |

Broadcast application May 17, 1967

Planted May 29 - 30

Harvested October 28, 1967

The Albertsen location was a surface irrigation experiment, all of replication 1 and several treatments of replication 2 silted in and were lost to water rot. Replications 2, 3 and 4 contained varying amounts of water rot. As a result, the trial yielded little effective information.

The yield, market grade and specific gravity data taken, are shown in Appendix Tables No. 11, 12 and 13. The yield and specific gravity data follow the same trend at Albertsen's as at Frederick's, except that there was probably less response to potassium at Albertsen's than at Frederick's. Chemical analysis was not determined at this location.

Madras Location

Central Oregon Experiment Station at Madras

Soil type: Madras loam

Irrigation: Row (surface)

Soil test:

| | | |
|---|---|---|
| 0-8" | depth | |
| | pH | 7.6 |
| | P #/A | 45.6 |
| | K #/A | 1497.6 |
| | Ca me/100 gms | 12.8 |
| | Mg me/100 gms | 6.5 |
| 8-16" | depth | |
| | pH | 7.7 |
| | P #/A | 11.1 |
| | K #/A | 1123.2 |
| | Ca me/100 gms | 11.8 |
| | Mg me/100 gms | 8.1 |

Culture:

This location was a victim of cultural problems.

The field had been seeded to rye the previous fall in order to increase the organic matter and improve the moisture relationships. Even though the field had been irrigated early to keep the soil moist and provide water for the rye, a poorly timed shower postponed plowing until the soil was basically too dry deep for potatoes.

During planting, the planter broke down and two days were required to make repairs. A poor stand was obtained in the area where planting was delayed by the breakdown.

As the season progressed it became increasingly more difficult to get water into the soil and finally, the irrigation practice was to irrigate on each side of the row of every row six hours each day.

The results obtained reflect the cultural problems, a large amount of variation in the yields between replications can be observed in Appendix Table No. 14. There was no statistical significance between treatments. Certain results appear to be revelant and should be watched in future experiments.

With the climatic conditions of 1967, 150# of N per acre did not appear to be sufficient. (See Table No. 3). Phosphate uptake from plowed down phosphate fertilizer was not satisfactory at least in the early stage of growth. The yield, however, was only slightly under that of banded phosphate. The high rate of banded phosphate (240# per acre) appeared to have a deleterious effect on yield. This effect may have been due to a drastically lowered pH in the band.

The trial indicates a deficiency of phosphate (Table No. 4) at the 0-80 rates of phosphate and the need of increasing the rate of phosphate application in the recommendations. Using .35% phosphate as the critical minimum value for phosphate in the plant at bud stage, then at least 160# of phosphate with a soil test of 44# of phosphate per acre to raise the phosphate level in the plant to this critical level. If rates above 150# of N per acre are applied, then the phosphate level should probably be increased. It appears that under usual farming practices it would be desirable to add nitrogen and phosphate at a 1:1 ratio. On fields with heavy applications of barnyard manure, either phosphate should be added to the manure or a ratio of greater than 1:1 phosphate should be used in the commercial fertilizer.

The plant analysis also indicates an adequate level of K uptake by the plants (9% is the probable critical minimum level for late bud stage sampling). It should be emphasized, however, that the soil test value for K at the 0-8" depth was approximately 1500 pounds per acre at this location.

Table No. 3 presents along with yield, the market grade and specific gravity of the potatoes. The grade reflects the water and temperature problems of 1967. The specific gravity, with passed knowledge that increased nitrogen and potassium lowers the specific gravity and that increased phosphate increases specific gravity, very closely reflects the chemical changes indicated by plant chemical analysis shown in Table No. 4.

The data summarized in the two tables in the text are presented showing the values obtained by replicate in Appendix Tables No. 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23.

## Summary

It should be emphasized that the points made below are from data obtained in the first year of this particular experiment and that the next year's data under different climatic conditions may change some of the interpretations of treatment effects.

### Nitrogen:

The experiment was not designed to obtain much information on nitrogen because responses to nitrogen have not been a problem. The experiment did indicate, however, that under the long growing season and warm weather of 1967, 150# of N per acre was not enough for optimum yields, judging from the early breakdown of vines receiving this rate of application at each of the three locations.

Table No. 3

The Effect of Nitrogen, Phosphate and Potassium Fertilizer Treatments on the Average Yield, Market Grade and Specific Gravity of Russet Burbank Potatoes

Madras Location - Central Oregon Experiment Station - 1967

| Fertilizer Application Pounds Per Acre | | | Average Yield | Market Grade Percentage | | | Specific |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | Tons/Acre | No. 1 | No. 2 | Culls | Gravity |
| 150 | 0 | 0 | 15.525 | 30.00 | 40.38 | 29.62 | 1.094 |
| 150 | 0 | 100 | 15.646 | 30.02 | 37.76 | 32.26 | 1.090 |
| 150 | 80 | 100 | 17.604 | 34.50 | 42.52 | 23.00 | 1.091 |
| 150 | 160 | 100 | 18.751 | 27.52 | 32.76 | 39.76 | 1.091 |
| 150 | 240 | 100 | 15,749 | 45.50 | 29.26 | 25.26 | 1.093 |
| 150 | 160 pl | 100 | 18.303 | 36.26 | 34.76 | 29.00 | 1.088 |
| 250 | 0 | 100 | 16.638 | 35.76 | 27.02 | 37.26 | 1.093 |
| 250 | 80 | 100 | 16.345 | 32.26 | 34.76 | 33.00 | 1.090 |
| 250 | 160 | 100 | 18.242 | 34.76 | 37.26 | 28.00 | 1.087 |
| 250 | 240 | 100 | 17.138 | 22.26 | 34.26 | 43.50 | 1.091 |
| 250 | 160 pl | 100 | 17.673 | 33.02 | 37.26 | 29.76 | 1.087 |
| 150 | 160 | 0 | 15.249 | 29.00 | 36.50 | 34.50 | 1.094 |
| 250 | 160 | 0 | 16.870 | 32.00 | 37.76 | 30.26 | 1.091 |
| 250 | 160 | 100 | 17.690 | 25.26 | 38.02 | 36.76 | 1.090 |
| 350 | 160 | 100 | 17.000 | 24.26 | 51.76 | 24.00 | 1.091 |
| 150 | 80 | 100 | 15.266 | 29.76 | 36.26 | 34.00 | 1.091 |
| 250 | 80 | 100 | 15.008 | 29.52 | 37.26 | 33.26 | 1.092 |
| 150 | 160 | 100 | 13.091 | 28.26 | 37.26 | 34.50 | 1.094 |

Table No. 4

The Effect of Nitrogen, Phosphate and Potassium Treatments on the Uptake of Phosphorus, Potassium, Magnesium, Calcium, Zinc, Manganese and Iron in the Petioles of Russet Burbank Potatoes Grown at the Madras Location - Central Oregon Experiment Station - 1967

| Fertilizer Application Pounds Per Acre | | | Average Yield | Petiole Content | | | | Leaf Content | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | Tons/Acre | P % | K % | Mg % | Ca % | Zn PPM | Mn PPM | Fe PPM |
| 150 | 0 | 0 | 15.5 | .21 | 11.2 | .57 | 1.01 | 27 | 43 | 146 |
| 150 | 0 | 100 | 15.6 | .21 | 11.5 | .56 | 1.02 | 32 | 51 | 145 |
| 150 | 80 | 100 | 17.6 | .30 | 11.8 | .49 | .95 | 27 | 54 | 129 |
| 150 | 160 | 100 | 18.8 | .40 | 11.5 | .49 | .94 | 25 | 53 | 137 |
| 150 | 240 | 100 | 15.7 | .40 | 11.6 | .60 | .97 | 19 | 49 | 149 |
| 150 | 160 pl(2) | 100 | 18.3 | .26 | 11.4 | .56 | .98 | 31 | 59 | |
| 250 | 0 | 100 | 16.6 | .24 | 11.3 | .59 | 1.00 | 35 | 51 | 142 |
| 250 | 80 | 100 | 16.3 | .28 | 11.6 | .55 | 1.12 | 25 | 51 | 134 |
| 250 | 160 | 100 | 18.2 | .32 | 11.2 | .53 | 1.11 | 22 | 48 | 135 |
| 250 | 240 | 100 | 17.1 | .30 | 10.9 | .60 | 1.18 | 21 | 43 | |
| 250 | 160 pl(2) | 100 | 17.7 | .26 | 11.5 | .58 | 1.09 | 24 | 51 | |
| 150 | 160 | 0 | 15.2 | .33 | 11.1 | .52 | 1.09 | 36 | 52 | 162 |
| 250 | 160 | 0 | 16.9 | .38 | 10.6 | .60 | 1.04 | 29 | 50 | 140 |
| 250 | 160 | 100(1) | 17.7 | .31 | 11.7 | .60 | 1.08 | 49 | 54 | |
| 350 | 160 | 100 | 17.0 | .35 | 11.3 | .61 | 1.04 | 34 | 43 | 154 |
| 150 | 80 | 100 | 15.3 | .34 | 11.6 | .52 | .93 | 37 | 60 | |
| 250 | 80 | 100 | 15.0 | .31 | 11.8 | .58 | .99 | 35 | 48 | |
| 150 | 160 | 100 | 13.1 | .37 | 11.1 | .60 | .98 | 21 | 48 | |

(1) 30# Zinc sulphate per acre - remainder of treatments no Zinc
(2) Phosphate plowed down prior to planting

Phosphate:

The yield and plant analysis data tend to indicate that the recommendations for phosphate have been low. With a soil test value of 45 pounds of P per acre, 180 pounds of $P_2O_5$ per acre in the band was required to alleviate the deficiency at the 150# N level. For higher than 150# of N probably higher rates of phosphate would be required. It appeared that under average conditions perhaps N and $P_2O_5$ should be applied at nearly a 1:1 ratio. This ratio probably would be low in phosphate where large amounts of barnyard manure were used.

High rates of phosphate (240# of $P_2O_5$) in a band appeared to decrease yield and have a harmful effect on the plant. It is suggested that possibly this high rate made the band too acid for the plant roots.

Plowed down phosphate was not picked up by the plant as effeciently as from the band, at least at the late bud stage, however, the yield was only slightly reduced by plowing down. It would appear that if high rates are necessary to alliviate a major deficiency of this element that probably some will necessarily have to be plowed down and some banded.

Potassium:

Potassium was not limiting at the Madras location, however, it should be emphasized that the soil test indicated 1500# per acre at the 0-8" depth. The yields tend to indicate that even here with large amounts of N and $P_2O_5$ banded a little potassium in the band helps the yield.

At the Frederick's location, phosphate was the first limiting nutrient, however, when the phosphate deficiency was alleviated, potassium was immediately deficient.

The data obtained from banded vs disced in vs plowed down potassium is rather inconclusive, which could mean that plowing down or discing in the potassium is as an efficient method of application as banding. The 450# K per acre rate banded was obviously harmful to the plant by observation, but at least under the conditions of the trial was not particularly detrimental to yield.

Even with the relatively low level of production rates between 225# and 450# of K per acre were required to raise the plant level of K out of the deficiency zone with soil test value of approximately 400# of K per acre. The range of soil test K at this location varied from 328-490# of K per acre and undoubtedly influenced the variability of the experiment.

A small experiment was established on the C. K. Minson Farm at Powell Butte to measure:

1. The effect of high rates of phosphate and potassium on yield.

2. The effect of zinc on the yield when high rates of phosphate are applied.

The soil test prior to the application of fertilizer was:

| | |
|---|---|
| pH | 6.0 |
| P #/A | 24.6 |
| K #/A | 324.5 |
| Ca me/100 gms | 6.58 |
| Mg me/100 gms | 5.18 |

Previous experiments in this area have indicated by plant analysis that applications up to 140# $P_2O_5$ per acre were not sufficient to alleviate the phosphate deficiency in this area where high rates of nitrogen and potassium were used. Also, the area is apparently on the threshold of a zinc deficiency.

All treatments were disced in. It was realized after the application that 500# of 16-20 had been plowed down, consequently the lowest rate of phosphate application was 220# $P_2O_5$ per acre.

No significant responses to the zinc or potash applications were obtained, however, there was a tendency for the 800# K rate to yield more than the 400# rate.

The results are shown in Table No. 5. It is interesting to note that, while it wasn't statistically significant, there was a trend for the high phosphate rate to lower the specific gravity. Usually phosphate increases specific gravity.

Table No. 5

Effect of Two Rates of Phosphate, Potassium and Zinc Fertilizers on the Yield and Specific Gravity of Russet Burbank Potatoes

C.K. Minson Farm - Powell Butte, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | Average Yield | Average Specific |
|---|---|---|---|---|
| $P_2O_5$ | K | $ZnSO_4$ | Tons/Ac. | Gravity |
| 120 | 400 | 30 | 17.88 | 1.077 |
| 240 | 400 | 30 | 19.16 | 1.075 |
| 240 | 800 | 30 | 19.37 | 1.073 |
| 120 | 400 | -- | 19.42 | 1.077 |
| 240 | 400 | -- | 18.14 | 1.075 |
| 240 | 800 | -- | 20.67 | 1.074 |

Yield Comparisons Based on Average Values

| Treatment #/A | Tons Per Acre |
|---|---|
| 0# $ZnSO_4$ | 19.41 |
| 30# $ZnSO_4$ | 18.80 |
| 400# K | 18.65 |
| 800# K | 20.02 |
| 120# $P_2O_5$ | 18.65 |
| 240# $P_2O_5$ | 19.33 |

Appendix Table No. 1

Effect of Rates of Nitrogen, Phosphate and Potassium Fertilizer Treatments and Methods of Application of Phosphate and Potassium on the Yield of Russet Burbank Potatoes

Eugene Fredrick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | Yield of Potatoes in Tons Per Acre By Replicate | | | | |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | I | II | III | IV | Ave. |
| 150 | 0 | 0 | 8.597 | 10.375 | 7.690 | 13.494 | 10.039 |
| 150 | 160 | 0 | 13.966 | 14.800 | 11.100 | 13.277 | 13.286 |
| 150 | 0 | 75(2x2)150pl | 11.934 | 9.069 | 9.468 | 7.763 | 9.559 |
| 150 | 80 | 0 | 12.660 | 14.945 | 13.422 | 11.100 | 13.032 |
| 150 | 160 | 0 | 13.676 | 14.437 | 15.888 | 13.712 | 14.428 |
| 150 | 240 | 0 | 12.370 | 11.971 | 11.608 | 12.043 | 11.998 |
| 150 | 160 | 75(2x2) | 13.531 | 14.292 | 13.857 | 10.302 | 12.996 |
| 150 | 160 | 225(2x2) | 14.401 | 13.857 | 15.163 | 12.043 | 13.866 |
| 150 | 160 | 450(2x2) | 14.546 | 14.655 | 12.841 | 12.261 | 13.576 |
| 150 | 160 | 225 disc | 12.225 | 16.106 | 12.261 | 10.447 | 12.760 |
| 150 | 160 | 450 disc | 11.535 | 14.873 | 14.147 | 10.012 | 12.642 |
| 150 | 160 | 225 plow | 13.785 | 13.712 | 10.157 | 12.116 | 12.443 |
| 150 | 160 | 450 plow | 14.437 | 15.526 | 15.090 | 14.945 | 15.000 |
| 150 | 160 | 75(2x2)150pl | 15.453 | 15.671 | 14.655 | 10.230 | 14.002 |
| 150 | 160 | 75(2x2)375pl | 12.696 | 13.639 | 11.753 | 11.173 | 12.315 |
| 150 | 80/80 | 75(2x2)375pl | 14.655 | 16.541 | 13.132 | 11.826 | 14.039 |
| 150 | 160 | 75(2x2)150pl | 14.510 | 15.381 | 12.914 | 15.163 | 14.492 |
| 250 | 160 | 75(2x2)375pl | 14.002 | 15.961 | 15.888 | 16.251 | 15.526 |
| 250 | 240 | 75(2x2)375pl | 15.453 | 13.204 | 13.132 | 13.422 | 13.803 |
| 150 | 160 | 75(2x2)375pl | 14.220 | 14.002 | 11.826 | 17.412 | 14.365 |

Appendix Table No. 2

The Effect of Nitrogen, Phosphate and Potassium Treatments on the Market Grade of Russet Burbank Potatoes Grown on the Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | No. 1 % | | Total No. 1 % | No. 2 % | | Total No. 2 % | Culls % |
|---|---|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | 10 oz.+ | 10 oz.- | | 10 oz.+ | 10 oz.- | | |
| 150 | 0 | 0 | 6.26 | 39.62 | 45.88 | 16.90 | 12.40 | 29.20 | 24.96 |
| 150 | 160 | 0 | 14.58 | 37.22 | 51.80 | 11.22 | 14.22 | 25.44 | 22.80 |
| 150 | 0 | 75/150 | 9.16 | 36.48 | 45.64 | 7.42 | 19.82 | 27.24 | 27.14 |
| 150 | 80 | 0 | 8.60 | 37.00 | 45.60 | 11.50 | 19.62 | 31.12 | 23.30 |
| 150 | 160 | 0 (1) | 11.62 | 40.72 | 52.34 | 13.38 | 16.40 | 29.78 | 17.90 |
| 150 | 240 | 0 | 10.74 | 40.34 | 51.08 | 8.54 | 17.80 | 26.34 | 22.60 |
| 150 | 160 | 75 (2x2) | 9.86 | 34.88 | 44.74 | 13.40 | 18.28 | 31.68 | 23.60 |
| 150 | 160 | 225 (2x2) | 13.12 | 33.02 | 46.14 | 17.90 | 17.34 | 35.24 | 18.62 |
| 150 | 160 | 450 (2x2) | 10.32 | 30.38 | 40.70 | 18.66 | 15.32 | 33.98 | 25.34 |
| 150 | 160 | 225 disc | 6.54 | 33.50 | 40.04 | 9.16 | 21.38 | 30.54 | 29.44 |
| 150 | 160 | 450 disc | 4.50 | 33.26 | 37.76 | 11.00 | 17.50 | 28.50 | 33.76 |
| 150 | 160 | 225 plow | 9.26 | 30.50 | 39.76 | 7.76 | 23.26 | 31.02 | 29.26 |
| 150 | 160 | 450 plow | 10.76 | 32.26 | 43.02 | 13.76 | 18.76 | 32.52 | 24.50 |
| 150 | 160 | 75/150 | 8.50 | 32.26 | 40.76 | 11.26 | 22.26 | 33.52 | 25.76 |
| 150 | 160 | 75/375 | 3.50 | 29.00 | 32.50 | 4.50 | 22.00 | 26.50 | 41.00 |
| 150 | 80/80 | 75/375 | 6.76 | 34.76 | 41.52 | 13.50 | 20.26 | 33.76 | 24.76 |
| 150 | 160 | 75/150 | 11.26 | 25.50 | 36.76 | 19.00 | 18.76 | 37.76 | 25.50 |
| 250 | 160 | 75/375 | 10.26 | 34.26 | 44.52 | 15.76 | 16.26 | 32.02 | 23.50 |
| 250 | 240 | 75/375 | 8.50 | 24.00 | 32.50 | 15.00 | 21.26 | 36.26 | 31.26 |
| 150 | 160 | 75/375(1) | 11.26 | 41.76 | 53.02 | 11.00 | 12.50 | 23.50 | 23.50 |

(1) No Zinc - other treatments received 30# Zn $SO_4$ per acre

Appendix Table No. 3

The Effect of Nitrogen, Phosphate and Potassium Fertilizer Treatments on the Specific Gravity of Russet Burbank Potatoes

Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | Specific Gravity By Replicate | | | | |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | I | II | III | IV | Average |
| 150 | 0 | 0 | 1.074 | 1.078 | 1.076 | 1.076 | 1.0760 |
| 150 | 160 | 0 | 1.088 | 1.082 | 1.080 | 1.081 | 1.0828 |
| 150 | 0 | 75/150 | 1.075 | 1.074 | 1.074 | 1.072 | 1.0738 |
| 150 | 80 | 0 | 1.0[illegible] | 1.083 | 1.077 | 1.075 | 1.07[illegible] |
| 150 | 160 | 0 (1) | 1.086 | 1.082 | 1.077 | 1.080 | 1.0813 |
| 150 | 240 | 0 | 1.086 | 1.088 | 1.084 | 1.077 | 1.0838 |
| 150 | 160 | 75 (2x2) | 1.081 | 1.082 | 1.081 | 1.077 | 1.0803 |
| 150 | 160 | 225 (2x2) | 1.082 | 1.081 | 1.076 | 1.07[illegible] | 1.0788 |
| 150 | 160 | 450 (2x2) | 1.077 | 1.074 | 1.077 | 1.073 | 1.0753 |
| 150 | 160 | 225 disc | 1.079 | 1.084 | 1.074 | 1.073 | 1.0775 |
| 150 | 160 | 450 disc | 1.074 | 1.077 | 1.075 | 1.072 | 1.0745 |
| 150 | 160 | 225 plow | 1.081 | 1.082 | 1.074 | 1.075 | 1.0778 |
| 150 | 160 | 450 plow | 1.079 | 1.079 | 1.077 | 1.076 | 1.0778 |
| 150 | 160 | 75/150 | 1.077 | 1.077 | 1.077 | 1.075 | 1.0770 |
| 150 | 160 | 75/375 | 1.077 | 1.073 | 1.072 | 1.071 | 1.0733 |
| 150 | 80/80 | 75/375 | 1.076 | 1.077 | 1.075 | 1.067 | 1.0738 |
| 150 | 160 | 75/150 | 1.077 | 1.083 | 1.074 | 1.078 | 1.0780 |
| 250 | 160 | 75/375 | 1.076 | 1.081 | 1.075 | 1.072 | 1.0760 |
| 250 | 240 | 75/375 | 1.078 | 1.079 | 1.077 | 1.074 | 1.0770 |
| 150 | 160 | 75/375 (1) | 1.076 | 1.076 | 1.071 | 1.075 | 1.0745 |
| | | | | | L.S.D. @ 5% | | .0032 |
| | | | | | C. V. % | | .21 |

(1) No Zinc - Remainder of Treatments received 30# Zn $SO_4$ Per Acre

Appendix Table No. 4

The Effect of Several Fertilizer Treatments on the Percentage Phosphorus Content of the Petioles(1) of Russet Burbank Potatoes

Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | Percentage Phosphorus in Petiole (1) By Replicate | | | | |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | I | II | III | IV | Average |
| 150 | 0 | 0 | .17 | .21 | .19 | .22 | .20 |
| 150 | 160 | 0 | .38 | .31 | .41 | .35 | .36 |
| 150 | 0 | 75/150 | .20 | .19 | .23 | .26 | .22 |
| 150 | 80 | 0 | .29 | .31 | .29 | .30 | .30 |
| 150 | 160 | 0 | .38 | .33 | .30 | .31 | .33 |
| 150 | 240 | 0 | .42 | .41 | .37 | .39 | .40 |
| 150 | 160 | 75 (2x2) | .40 | .33 | .40 | .37 | .38 |
| 150 | 160 | 225 (2x2) | .29 | .35 | .33 | .27 | .31 |
| 150 | 160 | 450 (2x2) | .30 | .27 | .33 | .26 | .29 |
| 150 | 160 | 225 disc | .31 | .36 | .36 | .31 | .34 |
| 150 | 160 | 450 disc | .33 | .33 | .34 | .32 | .33 |
| 150 | 160 | 225 plow | .43 | .29 | .33 | .26 | .33 |
| 150 | 160 | 450 plow | .36 | .42 | .32 | .36 | .37 |
| 150 | 160 | 75/150 | .34 | .32 | .37 | .33 | .34 |
| 150 | 160 | 75/375 | .37 | .34 | .36 | .31 | .35 |
| 150 | 80/80 | 75/375 | .35 | .34 | .32 | .27 | .32 |
| 150 | 160 | 75/150 | .33 | .30 | .32 | .35 | .33 |
| 250 | 160 | 75/375 | .40 | .36 | .37 | .37 | .38 |
| 250 | 240 | 75/375 | .38 | .27 | .32 | .33 | .33 |
| 150 | 160 | 75/375 | .38 | .34 | .38 | .30 | .35 |

(1) Sample taken late bud or early bloom

Appendix Table No. 5

The Effect of Several Fertilizer Treatments on the Percentage Potassium Content of the Petioles(1) of Russet Burbank Potatoes

Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | Percentage Potassium in Petiole (1) By Replicate | | | | |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | I | II | III | IV | Ave |
| 150 | 0 | 0 | 9.00 | 9.50 | 9.70 | 12.20 | 10.10 |
| 150 | 160 | 0 | 7.10 | 8.90 | 7.90 | 9.10 | 8.25 |
| 150 | 0 | 75/150 | 10.60 | 9.50 | 10.70 | 11.70 | 10.63 |
| 150 | 80 | 0 | 6.90 | 7.50 | 8.50 | 10.10 | 8.25 |
| 150 | 160 | 0 | 6.90 | 6.20 | 6.30 | 9.20 | 7.15 |
| 150 | 240 | 0 | 5.70 | 6.00 | 6.40 | 8.40 | 6.63 |
| 150 | 160 | 75 (2x2) | 8.50 | 8.50 | 9.50 | 9.70 | 9.05 |
| 150 | 160 | 225 (2x2) | 9.70 | 10.50 | 10.90 | 10.70 | 10.45 |
| 150 | 160 | 450 (2x2) | 9.00 | 10.70 | 11.60 | 8.50 | 9.95 |
| 150 | 160 | 225 disc | 8.80 | 10.30 | 11.10 | 10.20 | 10.10 |
| 150 | 160 | 450 disc | 10.30 | 11.20 | 10.70 | 12.00 | 11.05 |
| 150 | 160 | 225 plow | 8.80 | 9.70 | 10.50 | 9.70 | 9.68 |
| 150 | 160 | 450 plow | 9.70 | 10.00 | 11.00 | 10.70 | 10.35 |
| 150 | 160 | 75/150 | 9.70 | 10.20 | 11.00 | 11.60 | 10.63 |
| 150 | 160 | 75/375 | 10.30 | 10.90 | 10.60 | 12.20 | 11.00 |
| 150 | 80/80 | 75/375 | 11.00 | 10.20 | 11.40 | 11.00 | 10.90 |
| 150 | 160 | 75/150 | 10.50 | 10.30 | 10.70 | 12.00 | 10.88 |
| 250 | 160 | 75/375 | 11.20 | 10.30 | 11.50 | 12.00 | 11.25 |
| 250 | 240 | 75/375 | 10.00 | 10.30 | 10.70 | 10.00 | 10.25 |
| 150 | 160 | 75/375 | 10.50 | 11.00 | 10.90 | 11.20 | 10.90 |

(1) Sample taken late bud or early bloom

Appendix Table No. 6

The Effect of Several Fertilizer Treatments on the Percentage Calcium Content of the Petioles(1) of Russet Burbank Potatoes

Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | Percentage Calcium in Petiole (1) By Replicate | | | | |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | I | II | III | IV | Ave. |
| 150 | 0 | 0 | .99 | .97 | 1.13 | .88 | .99 |
| 150 | 160 | 0 | 1.13 | 1.04 | 1.04 | 1.18 | 1.10 |
| 150 | 0 | 75/150 | .90 | 1.01 | .88 | .94 | .93 |
| 150 | 80 | 0 | 1.04 | 1.08 | 1.18 | 1.11 | 1.10 |
| 150 | 160 | 0 | 1.13 | 1.18 | 1.20 | 1.08 | 1.15 |
| 150 | 240 | 0 | 1.28 | 1.13 | 1.20 | 1.08 | 1.17 |
| 150 | 160 | 75 (2x2) | 1.01 | .99 | 1.04 | 1.18 | 1.06 |
| 150 | 160 | 225 (2x2) | .99 | 1.04 | 1.11 | 1.13 | 1.07 |
| 150 | 160 | 450 (2x2) | .99 | .99 | .94 | 1.18 | 1.02 |
| 150 | 160 | 225 disc | 1.13 | 1.08 | 1.13 | 1.13 | 1.12 |
| 150 | 160 | 450 disc | 1.08 | 1.04 | 1.02 | 1.15 | 1.07 |
| 150 | 160 | 225 plow | .97 | 1.01 | 1.02 | 1.06 | 1.02 |
| 150 | 160 | 450 plow | 1.08 | .92 | 1.08 | 1.20 | 1.07 |
| 150 | 160 | 75/150 | 1.06 | .94 | .92 | .90 | .96 |
| 150 | 160 | 75/375 | .90 | .94 | .99 | 1.04 | .97 |
| 150 | 80/80 | 75/375 | .83 | .85 | .85 | 1.15 | .92 |
| 150 | 160 | 75/150 | .92 | .94 | .99 | .94 | .95 |
| 250 | 160 | 75/375 | .67 | .81 | .90 | .90 | .82 |
| 250 | 240 | 75/375 | .92 | .94 | .94 | .94 | .94 |
| 150 | 160 | 75/375 | .79 | .88 | .92 | .99 | .90 |

(1) Sample taken late bud or early bloom

Appendix Table No. 7

The Effect of Several Fertilizer Treatments on the Percentage Magnesium Content of the Petioles(1) of Russet Burbank Potatoes

Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | Percentage Magnesium in Petiole (1) By Replicate | | | | |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | I | II | III | IV | Ave. |
| 150 | 0 | 0 | .93 | 1.02 | 1.13 | .66 | .94 |
| 150 | 160 | 0 | 1.34 | 1.02 | 1.13 | 1.45 | 1.24 |
| 150 | 0 | 75/150 | .79 | .97 | .71 | .71 | .80 |
| 150 | 80 | 0 | 1.44 | 1.44 | 1.10 | 1.04 | 1.26 |
| 150 | 160 | 0 | 1.54 | 1.67 | 1.45 | 1.08 | 1.44 |
| 150 | 240 | 0 | 1.82 | 1.39 | 1.60 | 1.31 | 1.53 |
| 150 | 160 | 75 (2x2) | 1.27 | 1.35 | 1.20 | 1.14 | 1.24 |
| 150 | 160 | 225 (2x2) | 1.12 | .92 | 1.13 | .92 | 1.02 |
| 150 | 160 | 450 (2x2) | .96 | .88 | .74 | 1.14 | .93 |
| 150 | 160 | 225 disc | 1.12 | 1.07 | 1.20 | .97 | 1.09 |
| 150 | 160 | 450 disc | .92 | .97 | .94 | .84 | .92 |
| 150 | 160 | 225 plow | .97 | 1.07 | .97 | .88 | .97 |
| 150 | 160 | 450 plow | .92 | .84 | .92 | .94 | .91 |
| 150 | 160 | 75/150 | .99 | .97 | .74 | .68 | .85 |
| 150 | 160 | 75/375 | .86 | .80 | .84 | .86 | .84 |
| 150 | 80/80 | 75/375 | .76 | .82 | .75 | .92 | .81 |
| 150 | 160 | 75/150 | .80 | .80 | .80 | .66 | .77 |
| 250 | 160 | 75/375 | .57 | .74 | .71 | .74 | .69 |
| 250 | 240 | 75/375 | .77 | .77 | .99 | .74 | .82 |
| 150 | 160 | 75/375 | .68 | .63 | .77 | .70 | .70 |

(1) Sample taken late bud or early bloom

Appedix Table No. 8

The Effect of Several Fertilizer Treatments on the P.P.M. Zinc Content of the Petioles(1) of Russet Burbank Potatoes

Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | P.P.M. Zinc in Petiole (1) By Replicate | | | | |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | I | II | III | IV | Ave. |
| 150 | 0 | 0 | 52 | 44 | 32 | 52 | 45 |
| 150 | 160 | 0 | 44 | 36 | 38 | 28 | 37 |
| 150 | 0 | 75/150 | 64 | 50 | 38 | 54 | 52 |
| 150 | 80 | 0 | 60 | 58 | 50 | 38 | 52 |
| 150 | 160 | 0 | 34 | 28 | 14 | 30 | 27 |
| 150 | 240 | 0 | 38 | 28 | 22 | 22 | 28 |
| 150 | 160 | 75 (2x2) | 72 | 50 | 46 | 44 | 53 |
| 150 | 160 | 225 (2x2) | 78 | 86 | 78 | 40 | 71 |
| 150 | 160 | 450 (2x2) | 76 | 42 | 38 | 50 | 52 |
| 150 | 160 | 225 disc | 64 | 78 | 32 | 52 | 57 |
| 150 | 160 | 450 disc | 44 | 46 | 36 | 56 | 46 |
| 150 | 160 | 225 plow | 44 | 38 | 30 | 22 | 34 |
| 150 | 160 | 450 plow | 64 | 44 | 44 | 44 | 49 |
| 150 | 160 | 75/150 | 54 | 50 | 60 | 32 | 49 |
| 150 | 160 | 75/375 | 60 | 50 | 60 | 44 | 54 |
| 150 | 80/80 | 75/375 | 46 | 62 | 62 | 50 | 55 |
| 150 | 160 | 75/150 | 54 | 46 | 60 | 50 | 53 |
| 250 | 160 | 75/375 | 60 | 60 | 64 | 78 | 66 |
| 250 | 240 | 75/375 | 52 | 40 | 68 | 36 | 49 |
| 150 | 160 | 75/375 | 36 | 20 | 44 | 26 | 32 |

(1) Sample taken late bud or early bloom

Appendix Table No. 9

The Effect of Several Fertilizer Treatments on the P.P.M. Manganese Content of the Petioles(1) of Russet Burbank Potatoes

Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | P.P.M. Manganese in Petiole (1) By Replicate | | | | |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | I | II | III | IV | Ave. |
| 150 | 0 | 0 | 64 | 50 | 76 | 62 | 63 |
| 150 | 160 | 0 | 78 | 54 | 62 | 64 | 65 |
| 150 | 0 | 75/150 | 150 | 128 | 74 | 92 | 111 |
| 150 | 80 | 0 | 98 | 82 | 64 | 78 | 81 |
| 150 | 160 | 0 | 68 | 74 | 68 | 88 | 75 |
| 150 | 240 | 0 | 82 | 72 | 74 | 60 | 72 |
| 150 | 160 | 75 (2x2) | 170 | 104 | 104 | 96 | 119 |
| 150 | 160 | 225 (2x2) | 212 | 180 | 190 | 90 | 168 |
| 150 | 160 | 450 (2x2) | 200 | 92 | 82 | 156 | 133 |
| 150 | 160 | 225 disc | 216 | 186 | 78 | 102 | 146 |
| 150 | 160 | 450 disc | 116 | 124 | 88 | 92 | 105 |
| 150 | 160 | 225 plow | 96 | 118 | 76 | 60 | 88 |
| 150 | 160 | 450 plow | 156 | 114 | 126 | 102 | 125 |
| 150 | 160 | 75/150 | 150 | 114 | 108 | 76 | 112 |
| 150 | 160 | 75/375 | 160 | 130 | 100 | 88 | 120 |
| 150 | 80/80 | 75/375 | 116 | 112 | 106 | 82 | 104 |
| 150 | 160 | 75/150 | 102 | 144 | 96 | 116 | 115 |
| 250 | 160 | 75/375 | 100 | 116 | 134 | 176 | 132 |
| 250 | 240 | 75/375 | 100 | 82 | 142 | 68 | 98 |
| 150 | 160 | 75/375 | 78 | 82 | 68 | 82 | 78 |

(1) Sample taken late bud or early bloom

Appendix Table No. 10

The Effect of Several Fertilizer Treatments on the P.P.M. Iron Content of the Petioles(1) of Russet Burbank Potatoes

Eugene Frederick Farm, Terrebonne, Oregon - 1967

| Fertilizer Application Pounds Per Acre | | | P.P.M. Iron in Petiole (1) By Replicate | | | | |
|---|---|---|---|---|---|---|---|
| N | $P_2O_5$ | K | I | II | III | IV | Ave. |
| 150 | 0 | 0 | 374 | 144 | 338 | 144 | 250 |
| 150 | 160 | 0 | 144 | 156 | 186 | 132 | 155 |
| 150 | 160 | 0 | 192 | 156 | 156 | 150 | 164 |
| 150 | 160 | 75/150 | 156 | 168 | 192 | 108 | 156 |
| 150 | 160 | 75/375 | 192 | 174 | 168 | 138 | 168 |
| 150 | 160 | 75/150 | 246 | 204 | 204 | 216 | 218 |
| 250 | 160 | 75/375 | 228 | 144 | 204 | 228 | 201 |
| 250 | 240 | 75/375 | 204 | 240 | 132 | 144 | 180 |

(1) Sample taken late bud or early bloom