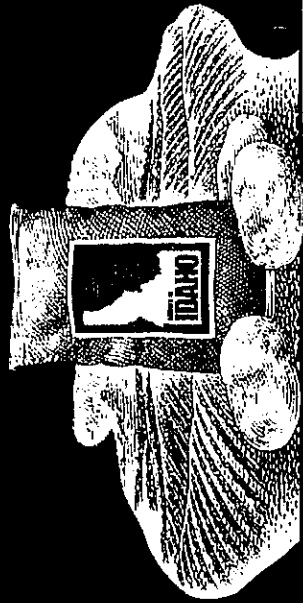


# BioFlora Markout Product Evaluation

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FAMOUS IDAHO POTATOES



University of Idaho  
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November 19, 2003

## **Field Evaluation of BioFlora's Markout Product**

Technical Report

submitted by:

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University of Idaho

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### **Executive Summary:**

This report contains the findings of a field evaluation of the BioFlora markout Product as compared to a "standard" markout blend. The study was conducted by Dr. Bryan Hopkins of the University of Idaho in cooperation with BioFlora, Inc and Kelly Brothers Farm on three fields near Idaho Falls, ID. The findings of this study show a remarkable improvement in both tuber yield and quality for the BioFlora treated plots. The average total yield improvement was 68-cwt./a when the BioFlora product was applied. When adjustments were made for quality parameters, the BioFlora treated plots exhibited a 55-cwt./a difference. There were consistently more of the 4-7 oz. tubers in all three fields. Other size differences were not consistently different across fields. Total tuber yield differences across fields ranged from 24 to 45-cwt./a increases with BioFlora treatment. Quality adjusted tuber yield differences across fields ranged from 41 to 70-cwt./a increases with BioFlora treatment. There were significantly less malformed tubers in two of the three fields. Total tuber numbers increased by 20%. It is also important to realize that the reason(s) for the differences in yield and quality have not been elucidated and cannot be isolated with a study of this nature. This study simply compares two markout programs, with the BioFlora product appearing to be superior. Although this study only represents one year of data, it is interesting to note that a similar study showed similar results with five different varieties in the previous year. The most substantial conclusion is that the BioFlora markout performed better than the "standard" markout in all eight fields evaluated over two years.

### Study Design:

The BioFlora product was applied by the grower, Kelly Brothers Farm, in a split field design across three separate fields in the spring of 2003 prior to planting in the Idaho Falls, ID area. The half of the field not receiving the BioFlora product received a markout application of "standard" fertilizer and soil amendments commonly used by the grower. The grower raised the potatoes in these fields following the farm's standard production practices. The Russet Burbank cultivar was planted in all three fields. Each side of each field was treated identically with the exception of the markout treatments. Petioles were sampled weekly in each half of the field during the vegetative, tuber initiation, and initial bulking stages.

Harvesting operations were completed by digging plot pairs selected by Dr. Hopkins the day of harvest. The fields were harvested between September 12-22. Each dig represents 30 ft<sup>2</sup> (10' X 3') of field area. Five pairs were dug in each field for a total of ten plots per field. A plot pair is made up of two plots: one with the BioFlora treatment and the other with "standard" practices. Efforts were made to insure that each pair had identical number of plants per plot and that each plot in the pair consisted of similar soil type, slope, pest damage, etc. Efforts were also made to have each individual plot relatively close to its paired neighbor to insure similar growing conditions, however, the distances between pairs varied in order to avoid digging out of the same rows when moving from one pair to another (distances between paired digs ranged from 15 to 120 ft.). Plots were selected randomly across the dividing line between treatments with significant effort being made to avoid bias in plot selection.

With regard to the data analysis, the statistical design is a replicated measurement paired t-test experimental design. Splitting a field is not a valid research design due to natural variations in the field. This can be evidenced by the fact that differences between one half of a field with the other are almost present without any treatment differences from one side to another. These differences are termed natural variability. Replicated and randomized plots assist the researcher in separating out natural variability from any treatment effects. The problems with split field design were overcome in this study by both the number of fields involved and the paired sampling protocol. Each field becomes a randomized "block" within the study in this case and the statistical analysis gains strength with increasing numbers of plots and fields. In effect, this study had three replications (field) with five sampled measurements of each.

### Results:

The raw plot data (per plot) is presented in Table 1 and converted data (estimated per acre) is presented in Table 2. A summary of the data is found in Table 3.

The combined data shows an increase in yield for the BioFlora treated test digs by an average of **68-cwt./a** total yield (Fig. 1) and **55-cwt./a** US No. 1 yield (Fig. 2). Total tuber yield differences across fields ranged from 24 to 134-cwt./a increases with BioFlora treatment (Fig. 1). US No. 1 tuber yield differences across fields ranged from 41 to 70-

cwt./a increases with BioFlora treatment (Fig. 2). There were consistently more of the 4-7 oz. tubers in all three fields by 35-cwt./a average (Fig. 3). Other size differences were not consistently different across fields (Fig. 3). The 7-14 oz. tubers significantly increased in one field, decreased in another, and was the same in the third. The >14 oz. tubers increased in one field and remained constant in the other two. Undersized tubers (< 4 oz.) dramatically increased in one field and remained constant in the other two. There were significantly less malformed tubers in two of the three fields. Total tuber numbers increased by 20% (Fig. 4).

The Freeway field showed an increase in yield for the BioFlora treated test digs by an average of 24-cwt./a total yield and 41-cwt./a US No. 1's. The 4-7 oz. size category had an increase of 38-cwt./a more than the standard markout. Similarly, the >14 oz. category showed a 29-cwt./a increase with BioFlora. Conversely, the 7-14 oz. size category showed a decrease of 26-cwt./a with BioFlora. In addition, the malformed and cull (<4 oz.) tubers decreased by 10 and 7-cwt/a, respectively. Total number of tubers increased by 10%.

The Hayner field showed an increase in yield for the BioFlora treated test digs by an average of 34-cwt./a total yield and 54-cwt./a US No. 1's. The 4-7 oz. size category had an increase of 51-cwt./a more than the standard markout. The other US No. 1 size categories showed essentially no differences. In addition, the cull (<4 oz.) tubers increased by 81-cwt/a, respectively. Total number of tubers increased by 37%.

The Lava (Dad's) field showed an increase in yield for the BioFlora treated test digs by an average of 45-cwt./a total yield and 70-cwt./a US No. 1's. The 4-7 oz. size category had an increase of 17-cwt./a more than the standard markout. Even more dramatically, the 7-14 oz. category showed a 49-cwt./a increase with BioFlora. There were essentially no differences in the >14 oz. size or the culls. In addition, the malformed tubers decreased by 23-cwt/a for the BioFlora. Total number of tubers increased by 17%.

The consistent increases in yield, US No. 1 yield, 4-7 oz. yield, and tuber numbers resulted in these harvest parameters showing strong statistical significance in favor of the BioFlora markout product.

### **Summary:**

The findings of this study show a remarkable improvement in both tuber yield and quality for the BioFlora treated plots. The average total yield improvement was 68-cwt./a when the BioFlora product was applied. Total tuber yield differences across fields ranged from 24 to 134-cwt./a increases with BioFlora treatment.

When adjustments were made for quality parameters, the BioFlora treated plots exhibited a 55-cwt./a difference. Quality adjusted tuber yield differences across fields ranged from 41 to 60-cwt./a increases with BioFlora treatment. The only size category that consistently and significantly increased for all three fields was the 4-7 oz., showing an

average increase of 35 cwt./a for the BioFlora treatment. The number of tubers also consistently increased by an average of 20%.

It is also important to realize that the reason(s) for the differences in yield and quality have not been elucidated and cannot be isolated with a study of this nature. The reason for the yield/quality improvement when BioFlora was applied may be due to differences in nutrient quantity, nutrient availability, microbial, growth regulator effects, and/or other variables that are represented by differences in the two markout mixtures. This study simply compares two markout programs, with the BioFlora product appearing to be superior.

It should also be noted that "split" fields are not an ideal experimental design. However, measuring paired replicates over multiple fields enables an adequate comparison for these two treatments. The relatively consistent and surprisingly large differences in yield and quality add to the degree of confidence that the findings of this study are accurate and not a result of natural variability. Consistent differences in the three fields, especially when combined with similar results in five fields from the previous year, dramatically increase the likelihood that the measured results are due primarily to treatment effects rather than random variation. Therefore, it is with a high degree of confidence that the differences observed in this study are accurate.

It is apparent that the BioFlora markout product is a quality product that can perform well when managed appropriately and in combination with other best management practices.

## Kelly Brothers Farm: BioFlora Markout Evaluation

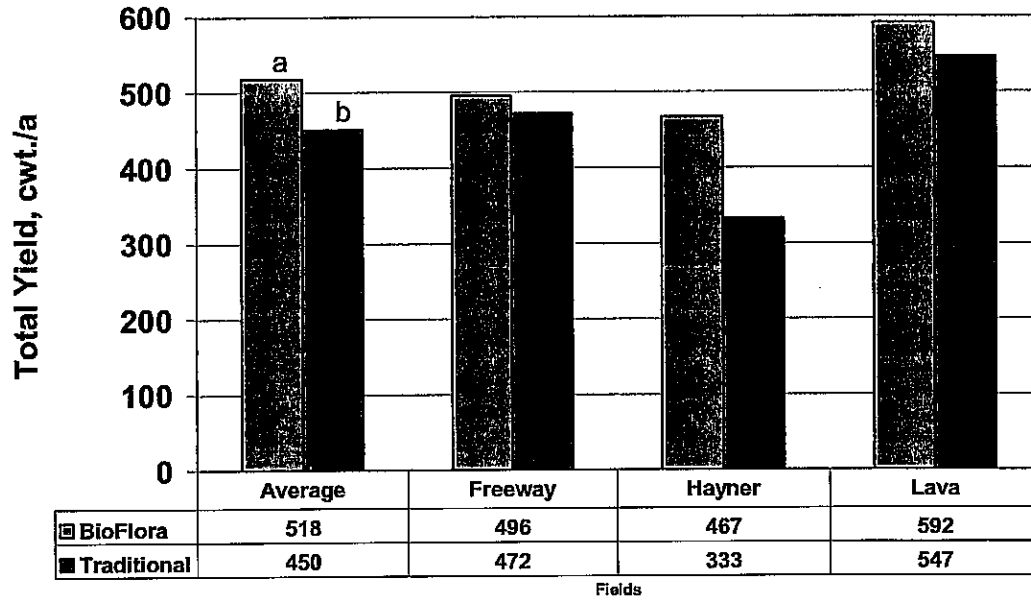


Fig. 1. Total tuber yield for BioFlora Markout evaluation study in 2003. The average tuber yield increase for BioFlora Markout was significantly greater than the “standard” markout at an alpha of 0.10 (90% confidence level).

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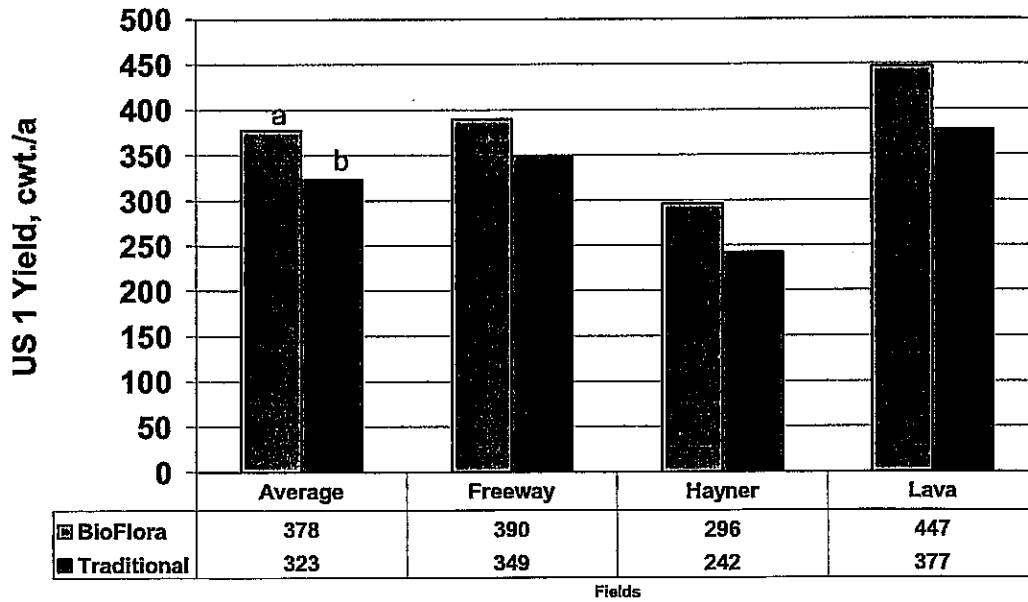


Fig. 2. US No. 1 tuber yield for BioFlora Markout evaluation study in 2003. The average yield increase for BioFlora Markout was significantly greater than the "standard" markout at an alpha of 0.10 (90% confidence level).

### Kelly Brothers Farm BioFlora Markout Evaluation

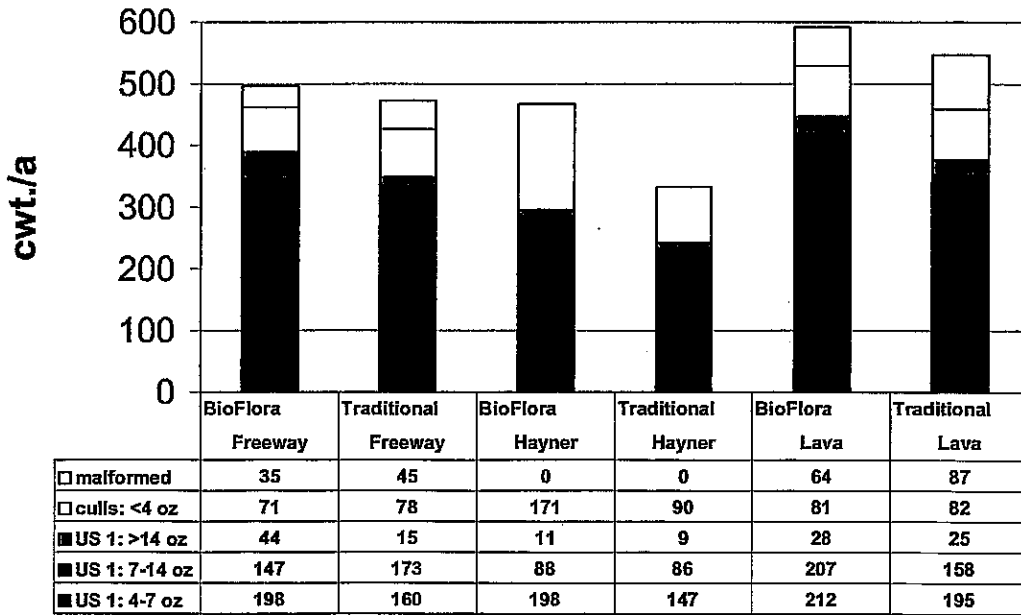


Fig. 3. Tuber yield breakdown for BioFlora Markout evaluation study in 2003.

## Kelly Brothers Farm: BioFlora Markout Evaluation

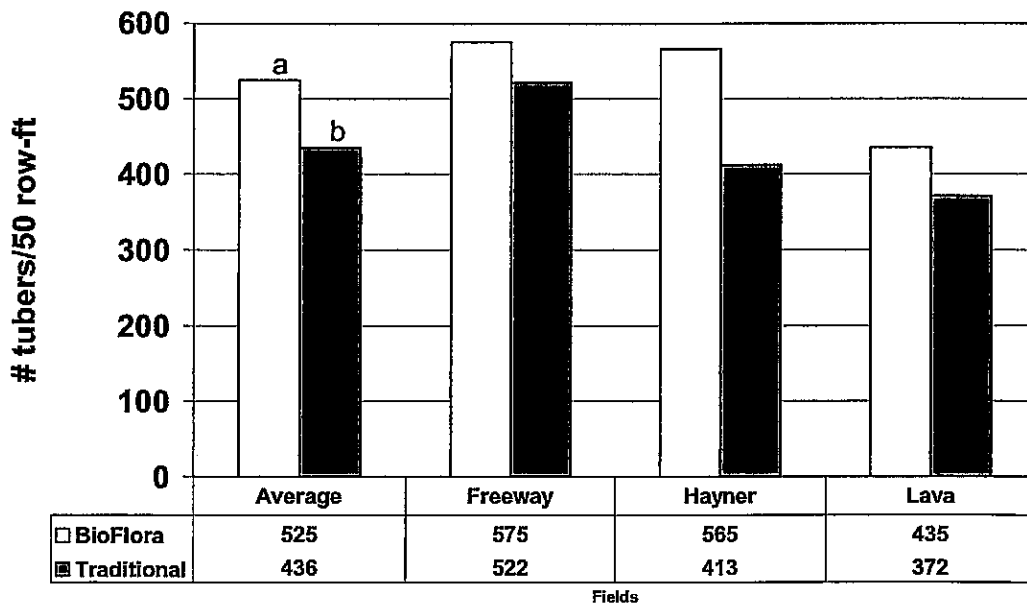


Fig. 4. Total tuber numbers for the BioFlora Markout evaluation study in 2003. The average tuber number increase for the BioFlora Markout was significantly greater than the “standard” markout at an alpha of 0.10 (90% confidence level).