# CONTROL OF YELLOW NUTSEDGE AND LATE EMERGING WEEDS IN ONIONS

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## Introduction

Effective weed control is essential for the production of marketable onions. Yellow nutsedge and annual weeds that emerge late in the season continue to reduce yields in commercial onion production. Trials were conducted to identify herbicides and weed control programs that provide effective weed control in onions. Yellow nutsedge tuber distribution in the soil also was determined.

## Procedures

Trials were conducted at the Malheur Experiment Station and on cooperators' fields to evaluate new and registered herbicides for weed control and onion tolerance. Herbicides were evaluated for control of late emerging weeds and for control of yellow nutsedge. Other trials were conducted to evaluated BAS 656 07 H for annual weed control in onions and to determine if preemergence applications of Prowl, Nortron, and carfentrazone would injure onions when applications were followed by overhead irrigation. All herbicide treatments were applied with a $CO_2$-pressurized backpack sprayer calibrated to deliver 20 gpa at 30 psi.

Data were analyzed using analysis of variance and means were separated using a protected least significant difference at the 5 percent level, LSD (0.05).

### Trials on the Station

On March 30, onions (cv. Vision, Petoseed) were planted at a 3.7-in spacing in double rows on 22-in beds. Plots were 4 rows wide and 30 feet long and arranged in a randomized block design with three or four replications. Lorsban was applied as a 6-in band over each row at 3.7 oz per 1,000 ft of row. Onions were sidedressed with 210 lb N/acre as urea on June 15. Insecticides and fungicides were applied for thrips and powdery mildew control. Weed control and onion injury were evaluated throughout the season. Onions were harvested September 24 and graded by size on September 28, 29, and 30.

*Late Emerging Weed Trial*
Plots were treated with a sequential postemergence herbicide program consisting of an initial application of Buctril (0.15 lb ai/acre) followed by two postemergence applications of Buctril (0.15 lb ai/acre), Goal (0.05 lb ai/acre), and Poast (0.1 lb ai/acre). Prowl (1.5 lb ai/acre) was added to different treatments at each of the various application times to provide residual weed control. Early applications of Prowl were compared to later applications and a split application, where half of the Prowl was applied during the first herbicide application and the rest was applied at lay-by. Prowl also was compared to other herbicides for residual weed control. Plots comparing different application timings for Prowl were not hand weeded, while plots comparing lay-by treatments were hand weeded prior to the application of the lay-by treatments. Herbicide applications were made April 26 (flag leaf), May 26 (3-leaf), and June 7 (4-leaf).

*Weed Control with BAS 656 07 H*
BAS 656 07 H was evaluated for weed control in onions. Combinations with BAS 656 07 H were applied May 27 when onions had three true leaves. Buctril was applied to all plots except the untreated on April 26. The entire study was treated with Buctril, Goal, and Poast on June 17.

*Onion Tolerance to Preemergence Herbicide Applications*
In this trial, preemergence herbicide applications were evaluated for onion tolerance. Prowl, Nortron, and carfentrazone were applied at different rates and Prowl was applied at two different timings. So that possible negative effects of the herbicides on onions could be isolated from weed control effects, all plots were maintained weed free by applications of Buctril, Goal, and Poast and by hand weeding. Prowl was applied at two rates (1.5 and 2.0 lb ai/acre) and two timings. Applications were made either directly after planting (preemergence, PRE) or after onions had germinated but had still not emerged (delayed preemergence, DPRE). Nortron (0.75, 1.0, 1.5, and 2.0 lb ai/acre) and carfentrazone (0.05 and 0.10 lb ai/acre) were applied at the PRE application timing. PRE applications were made April 2, and DPRE applications were made on April 15. After each herbicide application, 0.5 in of water was applied with overhead sprinklers. The soil was a loam with 1.5 percent organic matter and pH 8.5. In addition to visual injury evaluations, onion stand counts were taken by counting the number of onions per 39 in of row in the center two rows of each plot.

**Trials in Growers' Fields**

*Yellow Nutsedge Control Trials*
Two trials were established in a field heavily infested with yellow nutsedge. One trial evaluated preemergence herbicide applications for yellow nutsedge control, and the other trial evaluated postemergence herbicide applications for yellow nutsedge control. Onions were planted on a 3.7-in spacing in double rows on 22-in beds on May 3. The site was planted late because of delays in obtaining irrigation water. Plots were four

rows wide and 30 ft long and arranged in a randomized complete block design with four replications.

In the preemergence trial, preemergence applications were made May 5. Yellow nutsedge was growing vigorously before the onions had germinated, and, in order to reduce the nutsedge pressure, Roundup (0.75 lb ai/acre) was applied to both trials on May 11. Postemergence treatments were applied to both trials on June 17 and June 25. Buctril (0.125 lb ai/acre) and Goal (0.05 lb ai/acre) also were applied over both trials to control annual weeds not controlled by the herbicides applied for nutsedge control.

Nutsedge control was evaluated throughout the season. On August 25, two soil cores with a 4.25-in diameter and a 10-in depth were taken from each plot in the postemergence trial. The samples were washed through a 5/64-in mesh screen and the yellow nutsedge tubers were collected. Tubers were dried, counted, and weighed. Only viable tubers (tubers which were not easily crushed between the fingers) were included in the results. Tuber measurements were used to calculate nutsedge tuber numbers and yields on a per acre basis. Because of the late planting date and heavy competition from the yellow nutsedge, onion emergence was poor and a stand was not established. Onion injury evaluations and onion yields were not taken for either trial.

*Yellow Nutsedge Tuber Yield and Soil Distribution in Untreated Onions*
Soil cores were taken from the top of the onion bed in a field with an extremely high yellow nutsedge population to determine the number, yield, and soil distribution of tubers. The soil core probe had a 4.25-in diameter and was 10 in long. Soil from the core sample was separated into 2-in increments. Soil cores were replicated three times. Soil was washed from the samples, and nutsedge tubers were collected and dried. Non-viable tubers (those that could be crushed easily between the fingers) were removed, and the remaining tubers were counted and weighed.

## Results and Discussion

### Trials on the Station

*Late Emerging Weed Trial*
Application timing of Prowl affected the level of weed control attained on various species. Prowl did not increase redroot pigweed control regardless of application timing (Table 1). Applying Prowl with the first postemergence application or as a split application improved common lambsquarters control compared to the treatment with no Prowl. Among plots receiving Prowl, application timing did not affect common lambsquarters control. Hairy nightshade control was improved with the split application of Prowl compared to Prowl applied only in the first, second, or third application. Barnyardgrass control also was improved when Prowl was applied in the first or second application and as a split application, compared to no Prowl or Prowl applied at lay-by

only. There were no differences in weed control among the various lay-by treatments applied after hand weeding. Prowl treatments alone did not provide season long weed control regardless of application timing, and colossal and total onion yields were lower in plots that were not hand weeded. This demonstrates the effect of late season weed competition on the production of colossal size onions.

*Weed Control with BAS 656 07 H*
Applications of BAS 656 07 H alone did not control weeds that already had emerged at the time of application. Because of this, applications of BAS 656 07 H in combination with other herbicides were generally more effective than BAS 656 07 H alone (Table 2). The addition of Poast to BAS 656 07 H significantly improved barnyardgrass control compared to the other treatments on June 14. Since BAS 656 07 H does not control weeds that have emerged, it needs to be applied in herbicide combinations that control the weeds that are present at the time of application. BAS 656 07 H may contribute to lay-by weed control.

*Onion Tolerance to Preemergence Herbicide Applications*
Prowl applied preemergence (PRE) and delayed preemergence (DPRE) did not reduce onion stand, cause onion injury, or affect onion yield (Table 3). Nortron at 1.5 lb ai/acre appeared to have reduced stands compared to some other treatments, but Nortron at 2.0 lb ai/acre was not different, suggesting this response was not due to the Nortron. PRE applications of carfentrazone caused severe injury to onions, burning the leaves off at the soil surface. A trend toward reduced onion stand and yield as the rate of carfentrazone increased was apparent. Carfentrazone at 0.10 lb ai/acre reduced jumbo, colossal, and total onion yields compared to all other treatments. These results suggest that onion tolerance to preemergence applications of Prowl and Nortron are high, while onion tolerance to carfentrazone is very low.

**Trials in Growers' Fields**

*Yellow Nutsedge Control Trials*
Because onion planting was delayed, treatment applications were also later than needed to effectively control yellow nutsedge. The preemergence application of Roundup slightly stunted the nutsedge, but only temporarily. In the preemergence trial, Dual II Magnum applied both PRE and again to 2-leaf (2-Lf) onions was the only treatment without Basagran that provided significant nutsedge suppression (Table 4). Nortron applied preemergence did not visibly affect nutsedge growth and did not increase nutsedge control when combined with other herbicide treatments. BAS 656 07 H applied alone at any of the application timings provided less than 15 percent nutsedge control. Applications of Dual II Magnum or BAS 656 07 H to 2-leaf onions followed by applications of Basagran and crop oil concentrate to 3-leaf onions resulted in greater nutsedge control than Dual II Magnum, BAS 656 07 H, or Basagran applied alone to 2-leaf onions.

In the postemergence trial, treatments containing Basagran provided greater than 80 percent nutsedge control several weeks after treatment (Table 5). However, nutsedge came back aggressively, and by August, only treatments containing both Basagran and Dual II Magnum were still providing greater than 38 percent nutsedge control. The poor activity of BAS 656 07 H and Dual II Magnum probably is related to lack of significant rainfall and the extremely high density of nutsedge. Two applications of Basagran plus COC controlled 89 percent of the nutsedge on July 7 but was providing only 19 percent by August 30. Interestingly, even though visual control was poor at the end of the season, the tuber samples revealed that all treatments except Dual II Magnum plus BAS 656 07 H reduced nutsedge tuber numbers, and all of the treatments reduced nutsedge tuber weight in comparison to the untreated check. The untreated check had over 67 million nutsedge tubers per acre and was equivalent to more than 4.5 tons of tubers per acre of soil 10 in deep. Even if herbicide treatments provided control of 99 percent of the tubers, those remaining would produce an overwhelming population of nutsedge plants. Even with the use of herbicides, onion production in a field with this type of infestation would be futile.

*Yellow Nutsedge Tuber Yield and Soil Distribution in Untreated Onions*

Soil core results showed that yellow nutsedge tubers were distributed throughout the top 10 in of the soil (Figure 1). These samples yielded over 79 million tubers per acre with a calculated weight of 5.9 tons of tubers per acre of soil 10 in deep. The largest number of tubers were present in the top 2 in of soil while the greatest weight of tubers came from the 4- to 6-in depth. Tubers at 4- to 6-in and 6- to 8-in depths were larger than those found at the 0- to 2-in or 2- to 4-in depths. Tuber numbers declined with each 2-in depth until 6 in, but did not decline from 6 to 10 in. The average weight per tuber was greater for tubers between 4 and 8 in deep compared to those in the top 4 in of soil. Future investigations of yellow nutsedge tuber distribution should include sampling to at least a 20-in depth in the soil to determine if yellow nutsedge tuber numbers and weight decline at depths greater than 10 in.

Table 1. Weed control and onion yield in response to application timing of soil-active herbicides, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

| Treatment† | Rate | Timing | Weed control‡ | | | | | Total onion yield§ |
|---|---|---|---|---|---|---|---|---|
| | | | Redroot pigweed | Common lambsquarters | Hairy nightshade | Barnyard-grass | Annual sowthistle | |
| | lb ai/acre | | ——— | ——————————%—————————— | | | | cwt/acre |
| No Lay-by | | | 66 | 88 | 68 | 40 | 75 | 331 |
| Prowl | 1.5 | 1-Leaf | 64 | 99 | 76 | 83 | 100 | 518 |
| Prowl | 1.5 | 2-Leaf | 70 | 95 | 77 | 93 | 96 | 610 |
| Prowl | 1.5 | Lay-by | 68 | 95 | 73 | 53 | 100 | 532 |
| Prowl + Prowl | 0.75 + 0.75 | 1-Leaf + Lay-by | 70 | 100 | 95 | 87 | 100 | 564 |
| Treflan + Hand weed | 0.75 | Lay-by | 94 | 100 | 100 | 87 | 100 | 969 |
| Prowl + Hand weed | 1.5 | Lay-by | 95 | 100 | 100 | 98 | 100 | 1,057 |
| Dual + Hand weed | 1.9 | Lay-by | 93 | 100 | 100 | 98 | 100 | 869 |
| BAS 656 07 H + Hand weed | 0.64 | Lay-by | 91 | 100 | 100 | 91 | 100 | 902 |
| Nortron + Hand weed | 0.75 | Lay-by | 85 | 100 | 100 | 91 | 100 | 742 |
| Prowl + Treflan + Hand weed | 0.75 + 0.75 | Lay-by | 94 | 100 | 100 | 92 | 100 | 1,028 |
| Untreated | | | 0 | 0 | 0 | 0 | 0 | 21 |
| LSD (0.05) | | | 8 | 9 | 10 | 16 | 21 | 208 |

†All plots except the untreated received Buctril on April 26 (Flag), Buctril plus Goal on May 26 ( 3-Leaf), and Buctril plus Goal plus Poast on June 7. Selected treatments were hand weeded prior to application of lay-by treatments on June 7.
‡Weed control ratings were taken June 30, except for annual sowthistle, which was evaluated July 27.
§Onions were harvested September 24.

Table 2. Weed control in onions with BAS 656 07 H combinations, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

| | | | Weed control | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Onion injury | | Redroot pigweed | | Common lambsquarters | | Hairy nightshade | | Barnyardgrass | | Onion yield[§] |
| Treatment[†] | Rate | Timing[‡] | 6-14 | 6-30 | 6-14 | 6-30 | 6-14 | 6-30 | 6-14 | 6-30 | 6-14 | 8-30 | |
| | lb ai/acre | | ----------%---------- | | | | | | | | | | cwt/acre |
| Frontier | 1.17 | 2-Leaf | 0 | 0 | 47 | 70 | 62 | 83 | 43 | 62 | 13 | 68 | 508 |
| BAS 656 07 H | 0.65 | 2-Leaf | 0 | 7 | 27 | 63 | 57 | 80 | 33 | 63 | 15 | 57 | 465 |
| BAS 656 07 H + Poast | 0.65 + 0.38 | 2-Leaf | 0 | 0 | 30 | 57 | 35 | 72 | 33 | 60 | 85 | 88 | 408 |
| BAS 656 07 H + Buctril | 0.65 + 0.125 | 2-Leaf | 0 | 3 | 50 | 72 | 73 | 85 | 60 | 77 | 18 | 60 | 705 |
| BAS 656 07 H + Prowl | 0.65 + 1.0 | 2-Leaf | 0 | 8 | 30 | 63 | 60 | 83 | 30 | 53 | 28 | 65 | 543 |
| BAS 656 07 H + Goal | 0.65 + 0.125 | 2-Leaf | 0 | 0 | 70 | 83 | 62 | 83 | 47 | 68 | 23 | 78 | 722 |
| Untreated | | | 0 | 12 | 0 | 25 | 0 | 25 | 0 | 32 | 0 | 47 | 89 |
| LSD (0.05) | | | NS | 8 | 24 | 21 | 29 | 19 | 17 | 14 | 19 | NS | 363 |

[†]All plots except the untreated received Buctril (0.15 lb ai/acre) on April 26. All plots including the untreated received Buctril (0.25 lb ai/acre), Goal (0.12 lb ai/acre), and Poast (0.19 lb ai/acre) on June 27.

[‡]Application to 2-leaf onions was on May 27.

[§]Onions were harvested September 24.

Table 3. Onion injury, density, yield, and grade in response to preemergence applications of Prowl, Nortron, and carfentrazone followed by overhead irrigation, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

| Treatment† | Rate | Timing‡ | Onion injury | Onion density | | Onion yield§ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5-11 | 6-25 | Small | Medium | Jumbo | Colossal | Total |
| | lb ai/acre | | --%-- | -----No/m----- | | ----------cwt/acre---------- | | | | |
| Prowl | 1.5 | PRE | 0 | 13.9 | 12.8 | 3.1 | 8.4 | 581 | 379 | 971 |
| Prowl | 2 | PRE | 0 | 13.5 | 11.5 | 1.8 | 8.0 | 479 | 442 | 931 |
| Prowl | 1.5 | DPRE | 0 | 14.4 | 12.8 | 1.2 | 10.8 | 559 | 344 | 916 |
| Prowl | 2 | DPRE | 0 | 13.8 | 12.7 | 1.4 | 6.8 | 588 | 381 | 977 |
| Untreated | | | 0 | 14.5 | 13.8 | 3.2 | 13.4 | 616 | 303 | 935 |
| Nortron | 0.75 | PRE | 0 | 14.7 | 14.0 | 2.0 | 11.2 | 647 | 266 | 926 |
| Nortron | 1 | PRE | 0 | 13.4 | 11.9 | 1.8 | 7.6 | 516 | 399 | 924 |
| Nortron | 1.5 | PRE | 0 | 12.7 | 12.3 | 1.9 | 10.3 | 547 | 330 | 890 |
| Nortron | 2 | PRE | 0 | 13.4 | 12.1 | 2.3 | 8.8 | 518 | 394 | 923 |
| Carfentrazone | 0.05 | PRE | 50 | 4.4 | 6.6 | 0.6 | 1.2 | 219 | 406 | 627 |
| Carfentrazone | 0.1 | | 70 | 2.6 | 2.3 | 0.0 | 0.6 | 78 | 132 | 210 |
| Untreated | | | 0 | 12.6 | 12.1 | 0.8 | 10.6 | 517 | 409 | 938 |
| LSD (0.05) | | | 3.4 | 3.6 | 3.6 | NS | NS | 218 | NS | 187 |

†Plots were maintained weed free with applications of Buctril, Goal, Poast, and hand weeding.
‡PRE= immediately after planting; DPRE=delayed preemergence, after germination but before emergence. Approximately 0.5 in of overhead irrigation was applied immediately after each application.
§Onions were harvested September 24.

Table 4. Yellow nutsedge control with preemergence herbicide applications in onions, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

| Treatment | Rate | Timing† | Yellow nutsedge control | | | | |
|---|---|---|---|---|---|---|---|
| | | | 7-1 | 7-8 | 7-15 | 8-4 | 8-30 |
| | lb ai/acre | | % | | | | |
| BAS 656 07 H | 0.64 + 0.64 | PRE + 2-Lf | 5 | 9 | 19 | 14 | 13 |
| BAS 656 07 H | 0.64 | 2-Lf | 0 | 5 | 11 | 10 | 3 |
| BAS 656 07 H | 1.28 | 2-Lf | 11 | 26 | 31 | 24 | 10 |
| BAS 656 07 H | 0.64 + 0.64 | 2-Lf + 3-Lf | 3 | 18 | 18 | 21 | 13 |
| Dual II Magnum | 1.6 + 1.6 | PRE + 2-Lf | 51 | 48 | 64 | 58 | 39 |
| Dual II Magnum | 1.6 | 2-Lf | 0 | 3 | 13 | 21 | 18 |
| Dual II Magnum | 3.2 | 2-Lf | 0 | 18 | 25 | 34 | 19 |
| Dual II Magnum | 1.6 + 1.6 | 2-Lf + 3-Lf | 0 | 15 | 19 | 43 | 30 |
| Nortron<br>Basagran + COC | 1.0<br>1.0 + 1% v/v | PRE<br>2-Lf | 80 | 75 | 58 | 14 | 3 |
| Nortron<br>Basagran + COC | 1.5<br>1.0 + 1% v/v | PRE<br>2-Lf | 80 | 76 | 59 | 14 | 8 |
| Nortron<br>Basagran + COC | 2.0<br>1.0 + 1% v/v | PRE<br>2-Lf | 80 | 76 | 63 | 20 | 5 |
| Nortron<br>BAS 656 07 H | 1.0<br>0.64 | PRE<br>2-Lf | 10 | 21 | 16 | 18 | 8 |
| Nortron<br>Dual II Magnum | 1.0<br>1.6 | PRE<br>2-Lf | 0 | 10 | 23 | 21 | 18 |
| Nortron<br>BAS 656 07 H<br>Basagran + COC | 1.0<br>0.64<br>1.0 + 1% v/v | PRE<br>2-Lf<br>3-Lf | 40 | 84 | 85 | 70 | 36 |
| Nortron<br>Dual II Magnum<br>Basagran + COC | 1.0<br>1.6<br>1.0 + 1% v/v | PRE<br>2-Lf<br>3-Lf | 40 | 83 | 85 | 81 | 54 |
| Untreated | | | 0 | 0 | 0 | 0 | 0 |
| LSD (0.05) | | | 10 | 10 | 8 | 10 | 9 |

†Treatments were applied preemergence (PRE) on May 5, to 2-leaf (2-Lf) onions on June 17, and to 3-leaf (3-Lf) onions on June 25.

Table 5. Yellow nutsedge control and nutlet production in response to postemergence herbicide applications in onions, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

| Treatment | Rate | Timing† | Yellow nutsedge control | | | | | Yellow nutsedge tuber | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 7-1 | 7-8 | 7-15 | 8-4 | 8-30 | Number | Weight |
| | lb ai/acre | | ---------- | ---------- | ---------- | %---------- | ---------- | 1,000/acre | ton/acre |
| Dual II Magnum | 1.25 | 2-Lf | 0 | 15 | 20 | 26 | 21 | 39,574 | 2.3 |
| BAS 656 07 H | 0.64 | 2-Lf | 3 | 36 | 31 | 19 | 5 | 42,669 | 2.2 |
| Basagran + COC | 1.0 + 1.0 % v/v | 2-Lf | 80 | 75 | 58 | 20 | 5 | 32,002 | 2.1 |
| Dual II Magnum + BAS 656 07 H | 1.25 + 0.64 | 2-Lf | 15 | 25 | 33 | 33 | 26 | 44,382 | 2.2 |
| Dual II Magnum + Basagran | 1.25 + 1.0 | 2-Lf | 80 | 79 | 80 | 60 | 41 | 14,426 | 0.5 |
| BAS 656 07 H + Basagran | 0.64 + 1.0 | 2-Lf | 80 | 78 | 73 | 40 | 18 | 21,279 | 0.9 |
| Dual II Magnum Basagran + COC | 1.25 1.0 + 1% v/v | 2-Lf 3-Lf | 35 | 74 | 84 | 66 | 46 | 23,766 | 1.0 |
| BAS 656 07 H Basagran + COC | 0.64 1.5 + 1.0% v/v | 2-Lf 3-Lf | 40 | 72 | 80 | 55 | 30 | 29,570 | 1.1 |
| Basagran + COC | 1.0 + 1.0% v/v | 2-Lf + 3-Lf | 85 | 89 | 87 | 52 | 19 | 23,877 | 0.8 |
| BAS 656 07 H + Basagran + COC | 0.64 + 1.0 + 1.0% v/v | 2-Lf | 80 | 80 | 75 | 46 | 19 | 24,208 | 1.0 |
| Dual II Magnum + Basagran + COC | 1.25 + 1.5 + 1.0% v/v | 2-Lf | 83 | 81 | 75 | 49 | 38 | 23,379 | 0.9 |
| Untreated | | | 0 | 0 | 0 | 0 | 0 | 67,982 | 4.6 |
| LSD (0.05) | | | 17 | 17 | 13 | 15 | 11 | 17,362 | 1.5 |

†Treatments were applied to 2-leaf (2-Lf) onions on June 17 and to 3-leaf (3-Lf) onions on June 25.

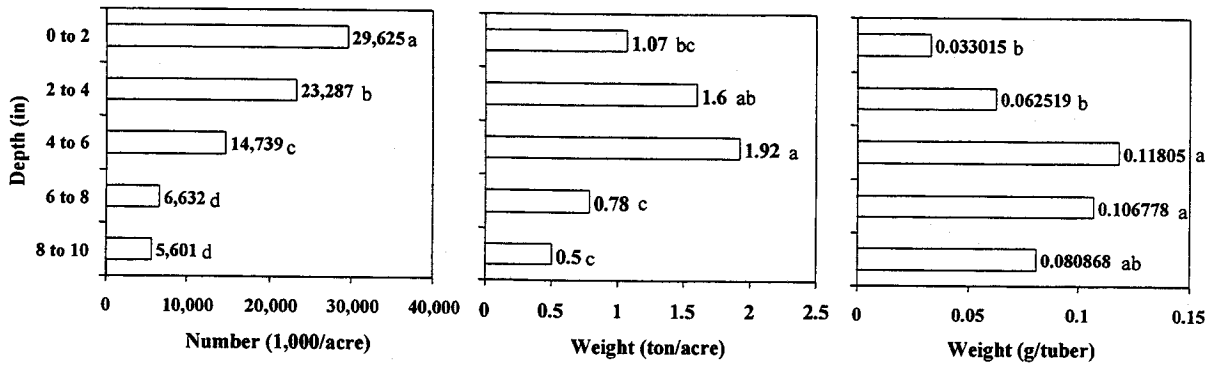


Figure 1. Yellow nutsedge tuber numbers and weigh at various depths in the soil in an untreated infestation. Numbers followed by different letters are significantly different at the 95 percent level of confidence, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.