

Original Research Article

Comparative Efficacy of Herbicides on Weed Dynamics, Productivity and Profitability of Onion

Apurva Minz*, Punam Horo, Sheela Barla, S. Sengupta,
Ravikant Rajak and Thakur Om Prakash Bibhuti

Department of Horticulture, Birsa Agricultural University, Ranchi, Jharkhand 834006, India

*Corresponding author

ABSTRACT

A field experiment was conducted at the Vegetable Research Farm under Department of Horticulture, Birsa Agricultural University, Ranchi, during the year 2016-17 to study the effect of different treatments on weed dynamics, productivity and profitability of onion. There were nine different treatments comprising of application of oxyfluorfen one week before transplanting, oxyfluorfen immediately after transplanting, pendimethalin one week before transplanting, pendimethalin immediately after transplanting, pretilachlor one week before transplanting, pretilachlor immediately after transplanting, quizolofop-ethyl 20 days after transplanting (DAT), hand weeding at 25 DAT and weedy check were laid out in randomized block design with three replications. Results revealed that highest weed control efficiency (63.45%) and lowest weed index (0.84%) was recorded in application of pendimethalin immediately after transplanting. Minimum weed density and weed dry weight of broad leaf and narrow leaf was recorded in pendimethalin immediately after transplanting while maximum was recorded in weedy check. Hand weeding at 25 DAT recorded maximum yield (237.06 q/ha). The application of pendimethalin immediately after transplanting gave the maximum net return of ₹ 175143.97 and BC ratio 2.93 while, the minimum net return ₹ 51005.95 and BC ratio 0.91 was recorded in weedy check.

Keywords

Herbicides,
Onion, Weed
dynamics,
Weed control
efficiency,
Weed index

Introduction

Weeds are the greatest constraint to yield in onion cultivation. Their infestation in onion is one of the key factors responsible for the lower productivity and poor quality of produce. The traditional methods of manual and mechanical weeding is quite effective, but arduous, time consuming and highly expensive. Under such situation, chemical weed control is a better option over conventional methods and use of herbicides forms an integral part of the modern crop production. In the last few decades different herbicides were used alone or in combination to eliminate the weeds but their efficiency differ because of their narrow

spectrum of weed control (Mani *et al.*, 2007). Severe labour crisis makes weed control very difficult at the critical period and causing huge yield gap. In such a situation herbicides are promising alternatives in controlling weeds. Herbicidal weed control is gaining popularity all over the world, a very little information is available on the effectiveness in controlling weeds. Indiscriminate use of these chemicals may lead to adverse effect on crops as well as the environment. So it is important to study the efficacy of herbicides on weeds and crops. Considering the above facts, the present investigation was undertaken to

study the efficacy of herbicides on weed dynamics, productivity and profitability of Onion.

Materials and Methods

The investigation was carried out in the Experimental Farm of Department of Horticulture, Birsa Agricultural University during the *Rabi* season of 2016-17 to study the effect of different treatments on weed dynamics, productivity and profitability of onion. The crop was transplanted at 45 days after sowing on 13th October 2016 on a sandy loam soil with medium fertility with a pH of 5.8. The nine different treatments comprised of oxyfluorfen one week before transplanting, oxyfluorfen immediately after transplanting, pendimethalin one week before transplanting, pendimethalin immediately after transplanting, pretilachlor one week before transplanting, pretilachlor immediately after transplanting, quizolofop-ethyl 20 days after transplanting (DAT), hand weeding at 25 DAT and weedy check were laid out in randomized block design with three replications. One hoeing at 45 DAT was carried out in all the treatments. Herbicides were applied using hand sprayer. The rest of the management practices were adopted in accordance with the recommended package of practices. The weed count and dry weight were subjected to square root transformation $\sqrt{(x+1)}$ for analysis. The crop was harvested on 15th February 2017. Economics of the treatments was computed based on the prevalent market prices of the inputs used and bulbs produced.

Results and Discussion

Effect on weeds

All the weed management practices caused significant reduction in weed density

compared with the weedy check. Application of pendimethalin immediately after transplanting of onion recorded less number of broad leaf and narrow leaf weed which was 56.54 and 64.79% less than weedy check, similarly dry weight of broad leaf and narrow leaf weed was 72.19 and 46.3% less than weedy check and this treatment was at par with application of pendimethalin one week before transplanting of onion. Consequently application of pendimethalin immediately after transplanting recorded maximum weed control efficiency i.e., 63.45 % followed by application of pendimethalin one week before transplanting i.e., 60.06 % and hand weeding recorded 58.64 % weed control efficiency (Table 1). Weed index is the indicator of losses in the yield due to presence of the weeds. Minimum yield loss compared to hand weeding was recorded by application of pendimethalin immediately after transplanting followed by pendimethalin one week before transplanting while maximum was in weedy check plots due to prominent weed-crop competition, suppression of crop plants by the emerging weeds and more utilization of nutrients and moisture by the weed canopy. Kolse *et al.*, (2010) also reported maximum weed index (57.95%) under weedy check plots.

Effect on onion

Hand weeding at 25 DAT similar to application of pendimethalin immediately after transplanting of onion recorded higher plant height, more number of leaves per plant and higher plant neck thickness compared to other treatments. The increase was in the tune of 78.88, 55.73 and 59.20% respectively than weedy check whereas, pendimethalin immediately after transplanting of onion recorded 63.94, 52.56 and 51.84% increase over weedy check.

Table.1 Density, dry weight of weeds, weed control efficiency and weed index as influenced by weed control methods in onion

| Treatment | Weed density (count per m ²) | | Weed dry matter (g/m ²) | | Weed control efficiency (%) | Weed Index (%) |
|---|--|-------------------|-------------------------------------|-------------------|-----------------------------|----------------|
| | Broad leaf weeds | Narrow leaf weeds | Broad leaf weeds | Narrow leaf weeds | | |
| Oxyfluorfen one week before transplanting | 4.18 (17.00) | 3.76 (13.66) | 2.32(5.01) | 2.52(5.97) | 52.89 | 20.39 |
| Oxyfluorfenimmediately after transplanting | 4.06 (16.00) | 3.33 (10.67) | 2.31(4.96) | 2.50(5.87) | 53.54 | 19.4 |
| Pendimethalin one week before transplanting | 3.89 (14.67) | 3.23 (10.00) | 2.18(4.38) | 2.30(4.93) | 60.06 | 4.78 |
| Pendimethalin immediately after transplanting | 3.71 (13.33) | 3.07 (9.00) | 2.16(4.31) | 2.14(4.21) | 63.45 | 0.84 |
| Pretilachlor one week before transplanting | 4.52 (20.00) | 4.60 (20.67) | 2.82(7.54) | 2.69(6.81) | 38.44 | 49.37 |
| Pretilachlorimmediately after transplanting | 4.37 (18.67) | 3.71 (13.33) | 2.66(6.67) | 2.47(5.72) | 46.85 | 49.23 |
| Quizolofop-ethyl 20 DAT | 4.30 (18.00) | 3.57 (12.33) | 2.62(6.46) | 2.39(5.35) | 49.34 | 36.57 |
| Hand weeding | 4.26 (17.67) | 3.01 (8.65) | 2.47(5.67) | 2.07(3.94) | 58.64 | 0 |
| Weedy Check | 5.58 (30.67) | 5.11 (25.56) | 3.99(15.50) | 2.87(7.84) | - | 55 |
| S.E m ± | 0.06 | 0.09 | 0.04 | 0.08 | | |
| CD (0.05%) | 0.18 | 0.28 | 0.12 | 0.25 | | |

Table.2 Growth character, yield and economics of onion production as influenced by weed control methods in onion

| Treatments | Plant height (cm) | Number of leaves | Plant neck thickness | Bulb neck thickness (cm) | Yield (q/ha) | Net return (₹) | B:C |
|---|-------------------|------------------|----------------------|--------------------------|--------------|----------------|------|
| Oxyfluorfen one week before transplanting | 51.20 | 5.07 | 3.62 | 1.31 | 188.53 | 129076.20 | 2.17 |
| Oxyfluorfen immediately after transplanting | 52.13 | 5.16 | 3.71 | 1.30 | 190.87 | 131416.20 | 2.21 |
| Pendimethalin one week before transplanting | 59.94 | 5.56 | 4.27 | 1.24 | 225.63 | 165923.97 | 2.77 |
| Pendimethalin immediately after transplanting | 61.10 | 5.87 | 4.54 | 1.16 | 234.85 | 175143.97 | 2.93 |
| Pretilachlor one week before transplanting | 43.70 | 4.67 | 3.01 | 1.40 | 119.88 | 60377.68 | 1.01 |
| Pretilachlor immediately after transplanting | 45.98 | 4.51 | 3.05 | 1.40 | 120.31 | 60807.68 | 1.02 |
| Quizolofop-ethyl 20 DAT | 49.07 | 4.96 | 3.57 | 1.31 | 150.33 | 90883.24 | 1.52 |
| Hand weeding | 66.67 | 5.98 | 4.76 | 1.13 | 237.06 | 130236.35 | 1.22 |
| Weedy Check | 37.27 | 3.84 | 2.99 | 1.41 | 106.78 | 51005.95 | 0.91 |
| S.E m ± | 3.71 | 0.35 | 0.28 | 0.05 | 3.82 | | |
| CD (0.05%) | 11.13 | 0.45 | 0.83 | 0.14 | 11.45 | | |

Bulb neck thickness in onion was minimum with hand weeding and was similar to application of pendimethalin immediately after transplanting of onion and pendimethalin one week before transplanting while maximum was with weedy check. Bulb neck thickness is an important character, because it indicates bulb storage ability. The onion with thin neck diameters are better than thick diameter.

Maximum yield was recorded in hand weeding plots followed by treatment pendimethalin immediately after transplanting of onion which was statistically at par with each other. Hand weeding recorded 122% more yield than weedy check. More yields in hand weeding plots (237.06 q/ha) seemed to be due to better weed control efficiency which might have created favourable environment by the clean crop culture resulting in more utilization of resources resulting in more photosynthetic rates and higher yield.

Among the herbicidal treatments maximum yield was recorded in the treatment pendimethalin immediately after transplanting of onion followed by application of pendimethalin 1 week before transplanting and oxyfluorfen immediately after transplanting due to their ability to inhibit emerging weeds like broad leaves, grasses and to some extent sedges also. Similar results were observed by Tripathy *et al.*, (2013), Vashi *et al.*, (2012).

The lowest yield attributes were recorded in weedy check plots due to unchecked weed growth resulting in denser weed which might have inhibited physiological growth of crop plants owing to low chlorophyll content and photosynthetic rate resulting in poor yield. (Channappagoudar and Biradar, 2007).

Effect on economics

Application of pendimethalin immediately after transplanting of onion recorded higher net return and B: C ratio, 70.88 and 68.94% higher than weedy check, followed by application of pendimethalin one week before transplanting, oxyfluorfen immediately after transplanting and oxyfluorfen one week before transplanting of onion. This could be attributed to lower cost of weed control in these treatments as compared to hand weeding plots. In hand weeding plots the cost of cultivation increased remarkably due to the employment of labourers for manual weeding. Although hand weeding plots resulted with reduced weed density, manual weeding was expensive due to engagement of large number of labourers. With increased cost of manual weeding thus corresponding towards total input cost. Moreover, un-weeded control recorded significantly lesser B: C ratio due to lower bulb yield owing to more crop weed competition. In accordance with other findings Kalhapure *et al.*, (2014) and Sampat *et al.*, (2014) also got minimum B: C ratio under the un-weeded plots.

From the above stated results it might be concluded that application of an herbicide performed better compared to hand weeding. Application of pendimethalin immediately after transplanting of onion might be best weed control practice to obtain higher grain yield and profit.

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