**Effect of Mechanical and Herbicidal Weed management practices on Growth and Nodulation of Urdbean**

**ABSTRACT**

A field experiment was conducted at Mechanized Agriculture Farm, Department of Agronomy, College of Agriculture, Ummedganj (Agricultural University, Kota) during *kharif,* 2023 to study the comparative efficacy of mechanical and herbicidal weed management practices in managing weeds and improving growth and nodulation of Urdbean [*Vigna mungo* (L.) Hepper]. Experiment was laid out in Randomized Block Design with ten treatment combinations with three replications. which includes Pendimethalin 30 EC @ 1.0 kg a.i./ha Pe, Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE, Imazethapyr 10 SL @ 55 g a.i./ha at 15-20 DAS, Clodinafop Propargyl 8 EC+Sodium-Aciflurofen 16.5 EC (Ready mix) @187.5 g a.i./h at 15-20 DAS, Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS (POE), Fluazifop-P-Butyl 13.4% EC @ 250 g a.i./ha at 15-20 DAS (POE), Mechanical weeding at 20 and 40 DAS, two hand weeding at 20 and 40 DAS, one hand weeding at 20 DAS and weedy check. Results revealed that Two hand weeding at 20 and 40 DAS significantly improved the plant height (50.30 cm), dry matter accumulation (117.51 g/mrl), number of nodules/plant (26.83), dry weight of nodules (41.49 mg/plant) of urdbean than rest of treatments.

**Key** **words**: Weed, Growth, Nodules, Urdbean, Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix), Herbicides, Hand weeding.

**INTRODUCTION**

Urdbean [*Vigna mungo* (L.) Hepper*.*] is s a 4th major pulse crop, after chick pea, red gram, and green gram and short duration pulse grown in many parts of India. Urdbean also known as blackgram, mash, black mapte *etc*. It supplies a major share of protein requirement of the vegetarian population of the nation. India is the largest producer and consumer of urdbean in the world. The crop improves soil fertility by fixing atmospheric nitrogen in the soil. Urdbean first reported being originated in India (Vavilov, 1926).

In India, urdbean occupied an area of 4.64 M ha with production of 2.76 MT having hovering productivity 520 kg/ha (Anonymous. 2021-2022). Rajasthan occupied an area of 5.96 lakh ha and production of 2.98 lakh tonn (Anonymous. 2021-2022).

Urdbean is grown in rainy season and like any other *kharif* season crop, The crop is resistant to adverse climatic conditions and improves the soil fertility by fixing atmospheric nitrogen in the soil. Among several factors responsible for low productivity, high weed incidence is one of the most important factors in urdbean cultivation. Weeds are the salient competitors or removers of natural and manmade resources like nutrients, water and light, which could have been otherwise used for boosting up crop productivity (Singh and Sheoran, 2008). The magnitude of reduction depends on the type and intensity of weed flora and the critical period of crop-weed competition in blackgram is the first 20-40 days after sowing and season long weed competition has been found to reduce blackgram yield to the extent of 27-84 per cent depending on the kind and intensity of weed species (Singh, 2011 and Bhowmick *et al.* 2015).

Weeds are controlled by various methods like cultural, manual, mechanical, chemical and biological. Manual and mechanical weeding is labour intensive and tedious. Many times, labours are not available at a peak time of requirement for weeding. Even if they are available the escalating cost of labourer’s further limits its option. Hand weeding, which is usually preferred, adds to the cost of cultivation due to higher labour wages and does not ensure weed removal at critical stages of crop-weed competition (Duary *et al.* 2015). Moreover, continuous rainfall during the season makes the manual weeding uncertain and impracticable. Hence, chemical weed control became an effective and cheaper alternative to manage weeds in blackgram production. The scope for application of either pre-sowing or pre-emergence herbicides under *kharif* season is also very little due to narrow elasticity in time of application. It has been now well understood that weed management is play a very important role for sustaining crop productivity. Therefore, removal of weeds at appropriate time using a suitable method is essential to achieve high yields of urdbean.

**MATERIAL AND METHODS**

A field experiment was conducted at Mechanized Agriculture Farm, Department of Agronomy, College of Agriculture, Ummedganj, Kota. The experiment was laid out in Randomized Block Design with ten treatment combinations with three replications, which includes Pendimethalin 30 EC @ 1.0 kg a.i./ha PE, Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE, Imazethapyr 10 SL @ 55 g a.i./ha at 15-20 DAS, Clodinafop Propargyl 8 EC+Sodium-Aciflurofen 16.5 EC (Ready mix) @187.5 g a.i./h at 15-20 DAS, Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha, Fluazifop-P-Butyl 13.4% EC @ 250 g a.i./ha at 15-20 DAS (POE) , Mechanical weeding at 20 and 40 DAS, two hand weeding at 20 and 40 DAS, one hand weeding at 20 DAS and weedy check. The soil of experimental field was clay loam in texture with adequate drainage facility, having moderately alkaline reaction, medium in organic carbon, available nitrogen, phosphorus and high in available potassium. Urdbean variety KU-4 was used as experimental material developed at ARS, Kota (Rajasthan).

**RESULTS**

**Effect on Growth**

**Plant height**

Results revealed that the plant hight at 25 DAS (21.67 cm) was increase significantly by two hand weeding at 20 and 40 DAS. Results further observed that two HW at 20 & 40 DAS noted the maximum plant height of 39.13 & 50.30 cm at 50 DAS and at harvest stage, among all the weed control treatments. Remaining at par with Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS, it enhanced the plant height to the magnitude of 42.48, 42.87, 43.21, 45.30 & 70.64 per cent at 50 DAS and 48.13, 49.02, 49.18, 49.30 & 76.00 per cent at harvest stage over one hand weeding at 20 DAS, Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE (RM), Pendimethalin 30 EC @ 1.0 kg a.i./ha PE, Mechanical weeding at 20 and 40 DAS and weedy check treatments, respectively. These treatments were significantly followed by Clodinafop Propargyl 8 EC + Sodium-Aciflurofen 16.5 EC (Ready mix) @ 187.5 g a.i./h at 15-20 DAS. (Table 1).

**Dry matter accumulation**

Differences in dry matter were more apparent at later stages of crop growth than early stages. Results revealed that tow hand weeding at 20 & 40 DAS, one hand weeding and Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS (Table 2) were the most superior and statistically similar treatment that observed significantly higher crop dry matter of 11.90, 11.77 and 11.33 g/m row length at 25 DAS. Results further showed that two HW at 20 and 40 DAS registered the highest crop dry matter of 117.51 g/mrl at harvest stage, among all the treatments. Remaining at par with Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS, it enhanced crop dry matter to the increase 75.54, 83.42, 92.26, 101.10 & 158.30 per cent at harvest stage over one hand weeding at 20 DAS, Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE (RM), Pendimethalin 30 EC @ 1.0 kg a.i./ha PE, Mechanical weeding at 20 and 40 DAS and weedy check treatments respectively. These treatments were significantly followed by Clodinafop Propargyl 8 EC + Sodium-Aciflurofen 16.5 EC (Ready mix) @ 187.5 g a.i./h at 15-20 DAS.

**Number of nodules/plants at 45 DAS**

The application of two hand weeding at 20 and 40 DAS produced significantly higher number of nodules/plant (26.83), which was significantly higher by 57.75, 58.34, 59.25, 60.14, and 92.58 per cent over, one hand weeding at 20 DAS, Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE (RM), Pendimethalin 30 EC @ 1.0 kg a.i./ha PE, Mechanical weeding at 20 and 40 DAS and weedy check treatments. respectively. However, two HW was statistically similar with and Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS. (Table 3).

**Dry weight of nodules at 45 DAS**

Maximum dry weight of nodules reported under two hand weeding at 20 and 40 DAS (41.49 mg/plant) being at par with Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS (40.01 mg/plant). These treatments registered 61.65 & 55.88, 61.94 & 56.17, 62.26 & 56.47, 62.49 & 56.70 and 98.04 & 90.98 per cent increase in dry weight of nodules/plant over one hand weeding at 20 DAS, Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE (RM), Pendimethalin 30 EC @ 1.0 kg a.i./ha PE, Mechanical weeding at 20 and 40 DAS and weedy check treatments, respectively. These treatments were significantly followed by Clodinafop Propargyl 8 EC + Sodium-Aciflurofen 16.5 EC (Ready mix) @ 187.5 g a.i./h at 15-20 DAS. The lowest dry weight of root nodules/plant was recorded 20.95 mg/plant under weedy check (Table 3).

**DISCUSSION**

The overall improvement in plant height, at 25, 50 DAS and harvest, dry matter accumulation, number of nodules and dry weight of nodules at 45 DAS under the influence of two hand weeding at 20 and 40 DAS could be attributed to better environment for growth and development that might be due to increased availability of nutrients to the growing plants. The lowest values of the growth parameters undergoing a weedy check could have the result of severe weed competition for resources, which made the crop plants ineffective at absorbing lighter, moisture and nutrients. Ultimately, growth was negatively impacted by a lack of carbohydrates. Chand *et al*. (2004), Jha *et al*. (2014) and Meena *et al*. (2012) reported similar findings.

**CONCLUSION**

The application of two hand weeding at 20 and 40 DAS recorded significantly higher plant hight, dry matter accumulation, number of nodules and dry weight of nodules of urdbean over weedy cheak and at par with Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS. Therefore, it was concluded that two hand weeding at 20 and 40 DAS may result in the better performance of urdbean crop.

**Table 1: Effect of weed control measures on plant height (cm) at different stages of urdbean**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **25 DAS** | **50** **DAS** | **At harvest** |
| Pendimethalin 30 EC @ 1.0 kg a.i./ha PE  | 13.23 | 27.33 | 33.72 |
| Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE | 13.39 | 27.39 | 33.75 |
| Imazethapyr 10 SL @ 55 g a.i./ha at 15-20 DAS | 16.04 | 31.18 | 39.14 |
| Clodinafop Propargyl 8 EC+Sodium-Aciflurofen 16.5 EC (Ready mix) @187.5 g a.i./h at 15-20 DAS | 18.47 | 34.90 | 44.85 |
| Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS | 21.02 | 38.67 | 50.01 |
| Fluazifop-P-Butyl 13.4% EC @ 250 g a.i./ha at 15-20 DAS (POE) | 16.12 | 31.19 | 39.70 |
| Mechanical weeding at 20 and 40 DAS | 13.15 | 26.93 | 33.69 |
| Two hand weeding at 20 and 40 DAS | 21.67 | 39.13 | 50.30 |
| One hand weeding at 20 DAS | 21.37 | 27.47 | 33.96 |
| Weedy check | 10.57 | 22.93 | 28.58 |
| SEm ± | 0.76 | 1.24 | 1.71 |
| CD (P=0.05) | 2.27 | 3.69 | 5.08 |

**Table 2: Effect of weed control measures on dry matter accumulation (g) /meter row length at different stages of urdbean**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **25 DAS** |  | **At harvest** |
| Pendimethalin 30 EC @ 1.0 kg a.i./ha PE  | 6.62 | 61.12 |
| Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE | 6.70 | 64.06 |
| Imazethapyr 10 SL @ 55 g a.i./ha at 15-20 DAS | 8.28 | 77.99 |
| Clodinafop Propargyl 8 EC+Sodium-Aciflurofen 16.5 EC (Ready mix) @187.5 g a.i./h at 15-20 DAS | 9.83 | 94.68 |
| Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS | 11.33 | 111.58 |
| Fluazifop-P-Butyl 13.4% EC @ 250 g a.i./ha at 15-20 DAS (POE) | 8.35 | 82.80 |
| Mechanical weeding at 20 and 40 DAS | 6.58 | 58.43 |
| Two hand weeding at 20 and 40 DAS | 11.90 | 117.51 |
| One hand weeding at 20 DAS | 11.77 | 66.94 |
| Weedy check | 5.35 | 45.49 |
| SEm ± | 0.41 | 3.29 |
| CD (P=0.05) | 1.22 | 9.77 |

**Table 3: Effect of weed control measures on number of nodules/plant and dry weight of nodules (mg/plant) at 45 DAS of urdbean**

|  |  |  |
| --- | --- | --- |
| **Treatment** | **Number of nodules/plants****at 45 DAS** | **Dry weight of nodules (mg/plant) at 45 DAS** |
| Pendimethalin 30 EC @ 1.0 kg a.i./ha PE  | 16.85 | 25.57 |
| Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE | 16.95 | 25.62 |
| Imazethapyr 10 SL @ 55 g a.i./ha at 15-20 DAS | 20.03 | 30.03 |
| Clodinafop Propargyl 8 EC+Sodium-Aciflurofen 16.5 EC (Ready mix) @187.5 g a.i./h at 15-20 DAS | 23.53 | 35.15 |
| Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS | 26.49 | 40.01 |
| Fluazifop-P-Butyl 13.4% EC @ 250 g a.i./ha at 15-20 DAS (POE) | 20.30 | 30.36 |
| Mechanical weeding at 20 and 40 DAS | 16.76 | 25.53 |
| Two hand weeding at 20 and 40 DAS | 26.83 | 41.49 |
| One hand weeding at 20 DAS | 17.01 | 25.67 |
| Weedy check | 13.93 | 20.95 |
| SEm ± | 0.93 | 1.43 |
| CD (P=0.05) | 2.76 | 4.26 |

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