The Pharma Innovation Journal 2021; 10(9): 1835-1839

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(9): 1835-1839

www.thepharmajournal.com
Received: 04-07-2021
Accepted: 16-08-2021

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# Efficacy of Flumioxazin 50% SL on weed dynamics, yield and economics of summer groundnut (*Arachis hypogaea* L.)

**Shalu Kumari, Ashok Pandit, RK Raj, Mahua Banerjee and GC Malik**

**Abstract**
A field experiment was conducted during the summer season of 2018 at Agricultural farm of Palli Siksha Bhavana (Institute of Agriculture), Visva Bharati, Sriniketan, Birbhum, West Bengal to the "Studies on Efficacy of Flumioxazin in summer Groundnut (*Arachis hypogaea* L.)". The experiment comprising of eight treatments was laid out in a randomized block design with three replications. From the experimental findings it was revealed that Groundnut was infested with three categories of weeds *viz*. grass, sedge and broadleaf. *Digitaria sanguinalis, Cynodon dactylon* among the grasses *Cyperus rotundus* among the sedges and *Alternanthera philloxeroides* among the broadleaved weeds were present as predominant weeds. Among the herbicides tested, lower values of weed index, weed density, weed dry weight and highest weed control efficiency was found with the pre-emergence application of Flumioxazin 50% SL 150 g a.i ha$^{-1}$ at 1 DAS which show better performed than Imazethapyr 10 SL 100 g a.i ha$^{-1}$ at 1 DAS and Pendimethalin 30% EC 750 g a.i ha$^{-1}$ 1 DAS in case of grasses, sedges and broadleaves but was at par with Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS. Application of Flumioxazin 50% SL 150 g a.i ha$^{-1}$ at 1 DAS and Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS were equally efficient in increasing the grain yield, straw yield and gross returns than untreated control but net returns (₹ 109161 ha$^{-1}$) and benefit-cost ratio (3.22) was obtained maximum only with Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS. Thus, Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS appeared as promising for managing broad-spectrum weeds and higher productivity of summer Groundnut in red and lateritic soils of West Bengal.

**Keywords:** Weed management, flumioxazin, groundnut

## Introduction
At this juncture, it must be admitted that the agricultural productivity should be sustained for providing food and nutrition to the mammoth population of the entire nation. Groundnut or peanut plays an important role in the dietary requirement of resource poor women and children and haulms are used as livestock feed (El Naim *et al*., 2011) [4]. Further, though Groundnut is a legume oilseed crop, it can fix a good amount of atmospheric nitrogen through its root nodules. India holds a major position in the global oilseed scenario (accounting for about 14% of the area and 8% of production) and among them Groundnut is one of the most important oilseed crops (Reddy, 2009) [20]. Area wise, about 85% Groundnut is grown during the kharif season under rainfed situation where the vagaries of monsoon and seasonal biotic and abiotic stresses attenuating the productivity (Dayal, 2004) [2]. There are several constraints in Groundnut production. Among them, one of the major constraints to raise the productivity of Groundnut crop is the weed infestation. A yield loss of 35 to 80 per cent due to weed infestation. Weeds not only compete with this crop for the resources but also interfere with pegging, pod development and harvesting of it. The critical period of crop-weed competition was found to be 4 to 8 weeks after sowing (Hamada, 1988) [5]. Thus, in case of Groundnut, early removal of weeds before flowering and during pegging is important (Page *et al*., 2002) [15]. Chemical control of weeds forms an excellent alternative to manual weeding (Sumathi *et al*., 2000) [23]. Herbicides, though selective in nature, are efficient and cost-effective measure for controlling weeds. So, effectiveness of herbicides greatly depends upon the habitat, weed composition and weed density with pre sowing or pre-emergence application of herbicides. Herbicide dose varies with the crop, soil type, climates and management practices. Presently, several herbicides like Trifluralin, Pendimethalin, Fluchloralin, are being used for controlling grassy weeds in Groundnut, but they have not been found much effective against broad leaved weeds up to some extent. So, there is a crucial need for the new herbicide molecules which could control both broad leaved and grassy weeds.

Flumioxazin herbicide is a member of diphenyl ether group of herbicides, which inhibits protoporphyrinogen oxidise (PPO). They inhibit the enzyme protoporphyrinogen oxidise (PPO or protox) which is the last enzyme in the pathway of chlorophyll biosynthesis. Protox inhibition in plants resulted in a rapid accumulation of protoporphyrin IX. In the presence of UV light, protoporphyrin IX can become a powerful source of singlet oxygen which causes lipid membrane per oxidation in plants leading to a rapid loss of turgidity and foliar burns. Therefore, an investigation was carried out to evaluate the efficacy of Flumioxazin as a herbicide for Groundnut.

## Materials and Methods

A field experiment was conducted under red and lateritic soils of West Bengal during summer season, 2018 at the Agricultural Farm, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West-Bengal which is situated an altitude of 59.00 meter above mean sea level and lies at 23º.66'N latitude and 87º.66'E longitude. The total rainfall received during the crop season was 16.6 mm. The soil was sandy loam (72.60% sand, 17.80% silt and 9.60% clay) in texture and strongly acidic in reaction (pH 5.5) with electric conductivity 0.26 dS/m, low in organic carbon (0.42%), available N (240 kg/ha), available phosphorus (25.54 kg/ha) and available potassium (150.00 kg/ha). Eight treatment combinations *viz.*, Flumioxazin 50% SL 75 g a.i ha$^{-1}$ at 1 DAS, Flumioxazin 50% SL 100 g a.i ha$^{-1}$ at 1 DAS, Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS, Flumioxazin 50% SL 150 g a.i ha$^{-1}$ at 1 DAS, Imazethapyr 10% SL 100 g a.i ha$^{-1}$ at 1 DAS, Pendimethalin 30% EC 750 g a.i ha$^{-1}$ at 1 DAS, untreated control and weed free check were tested in a randomized block design with three replications. The Groundnut variety, Tag-24 was sown on 25th of February 2018 in row 30 cm apart using seed rate of 120 kg ha$^{-1}$ in a plot measuring 12 m$^{-2}$. Seeds were treated with carbendazim to avoid the possible occurrence of the seed and soil borne diseases. The recommended dose of fertilizers (N: $P_2O_5$: $K_2O$- 20: 40: 60 kg ha$^{-1}$ as Urea, SSP and MOP) applied as basal prior to sowing. Flumioxazin, Pendimethalin and Imazethapyr was applied next day of sowing as per treatment. The herbicide spraying was done with flat fan nozzle. Four irrigations were given during the crop growing period. The data on weed population and weed biomass were taken at 30, 45, 60, 90 DAS and at harvest with the help of random quadrate (0.25 m$^2$) method. Weed control efficiency and weed index was calculated by employing formula as given by Tripathy and mishra (1971) [25].

$$\text{W. C. E} = \frac{\text{DWc} - \text{DWt}}{\text{DWc}} \text{X } 100$$

Where,

W.C. E= weed control efficiency, DWc = dry weight of weeds under weedy check plot, $DW_t$= dry weight of weeds under treated plot

$$\text{WI} = \frac{X-Y}{X} X100$$

Where

WI= Weed index (%), X=Yield obtained from weed free plot, Y= Yield obtained from treated plot Pod yield for each plant was obtained from the net plots and converted to ha$^{-1}$ pod yield. Aerial parts or haulm, after separation of pods were sun dried for seven days. Dry weight of this produce was taken as haulm yield. Yield of haulm per net plot was recorded and expressed on hectare basis. The economics of different treatments were computed by considering the prevailing market price of inputs and produce of Groundnut. The data were statistically analysed.

## Results and Discussion

### Weed Population (no. m$^{-2}$)

Population of weeds increased with advancement of crop age up to harvest under all the treatment. Data in table 1 showed that the untreated control (T7) registered significantly higher number of sedge, grassy and broadleaved weeds (no. m$^{-2}$) over all other treatments at all the stages of crop growth. No weed management practices were carried out in untreated control plot hence weed grew out as normal in undisturbed environment; hence higher weed population was recorded. No sedge, grassy and broadleaved weed at 30, 45, 60 DAS and at harvest was observed in the weed free check (T8) which may be due to complete removal of weed flora. Among the herbicidal treatment, the highest number of sedge, grassy and broadleaved weeds was registered in Pendimethalin 30% EC 750 g a.i ha$^{-1}$ at 1 DAS (T6). Application of Flumioxazin 50% SL 150 g a.i ha$^{-1}$ at 1 DAS (T4) plot recorded lowest number of sedge, grassy and broadleaved weeds which was statistically at par with Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS (T3) plot at all the stages of crop growth. Similar opinions regarding grassy weed control in Groundnut were also reported by Dubey *et al*. (2010) [3] and Kushwah and Vyas (2006) [12].

### Weed dry weight (g m$^{-2}$)

The data on the basis of dry weight of grassy, sedge and broadleaved weeds at 30, 45, 60 DAS & at harvest were presented in the table 2 revealed that the application of Flumioxazin 50% SL 150 g a.i ha$^{-1}$ at 1 DAS (T4) plot recorded lowest dry weight of grassy, sedge and broadleaved weeds which was statistically at par with Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS (T3) plot during whole crop growing season. The highest dry weight of grassy, sedge, and broadleaved weeds was observed in the plots of untreated control (T6). This might be due to unchecked growth in this system, where the weeds continued to grow freely and enjoyed all the growth factors more efficiently, and as such accumulated higher dry matter. Due to preemergence application of herbicide, intially weed dry weight decreased drastically but again tend to recoup towards maturity due to regeneration or commencement of new flushes. The weed dry weight slowly increased towards maturity of the crop because of decreasing trend of effectiveness resulting in regeneration of existing weeds and emergence of new weed seedlings in the later stages of crop growth. Similar opinions regarding grassy weed control in Groundnut were also reported by Dubey *et al*. (2010) [3], Kushwah and Vyas (2006) [12] and similar results were also recorded by the Kalhapure *et al*. (2013) [8] and Satyakumari *et al*. (2015) in case of broadleaved weed control in Groundnut.

### Weed control efficiency

Data in table 3 showed that the weed control efficiency in case of grassy, sedge, and broadleaved weeds at 30, 45, 60, DAS and at harvest, the highest values were observed in weed free plot (T8). Among the herbicidal treatments, weed control efficiency on grassy, sedge and broadleaved weeds at 30, 45, and 60 DAS was found highest in Flumioxazin 50% SL 150 g

a.i ha$^{-1}$ at 1 DAS (T4) plot and followed by Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS (T3) plot. At harvest, higher value of weed control efficiency in Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS (T3) plot followed by Flumioxazin 50% SL 150 g a.i ha$^{-1}$ at 1 DAS (T3) plot. More reduction in weed dry weight by reducing the weed density in these treatments might have resulted in higher weed control efficiency. Similar findings were recorded by the Kalhapure *et al*. (2013) [8]. These findings are similar with Priya *et al.* (2013) [17] and Jat *et al*. (2011) [7].

**Weed index**

Weed index (WI) is indirectly related to the reduction in yield due to weed population and weed dry weight. The calculate WI values was presented in table 4 indicated the extent of yield reduction due to weed competition. The reduction in WI was attributed to the low density of major weeds. It was observed very clearly that increasing the dose of Flumioxazin, WI was gradually decreased. The highest value of weed index recorded in weed free plot (T8). Among the herbicidal treatments lowest weed index value observed in Flumioxazin 50% SL 150 g a.i ha$^{-1}$ (T4) plot was close to that obtained in Flumioxazin 50% SL 125 g a.i ha$^{-1}$ (T3) plot. Similar findings were reported by Patel *et al*. (2013) [16] and Basavaraj *et al*. (2014) [1].

**Yield**

Results showed that the effect of all weed management strategies significantly influenced the yield of Groundnut over untreated control table 4. Among herbicidal treatment, Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS resulted significantly higher pod and haulm yield over untreated control but was at par with Flumioxazin 50% SL 150 g a.i ha$^{-1}$ at 1 DAS. Significant lowest values of pod yield and haulm yield were recorded under untreated control treatment due to severe Groundnut weed competition occurred throughout the growing period while highest values for those parameters were recorded under weed free treatment due to low crop-weed competition in critical period. Pod yield is an end product, which obviously depends upon the dry matter production of crop growth and its partitioning into reproductive parts. Therefore, increase in the dry matter of Groundnut was attributed to the decreased weed population and lesser dry weight of weeds thus resulted in decreased competition by weeds to moisture, light and nutrients. The effect of which can be traced back to increased dry matter accumulation in stem, leaves and pods. Murthy *et al.* (1992) [14] and Kumar and Sharma (1996) [10] have reported significant reduction in the dry matter accumulation and lower pod yield in Groundnut under weedy check. The dry matter production and its accumulation in reproductive parts depends upon the photosynthetic ability of the plant and can be analysed through leaf area and dry matter accumulation in leaves, which in turn influence the photosynthetic ability, performance and yield of the crop. The results collaborate with the findings of Kumar and Sharma (1997) [11] and Yadav *et al.* (2014) [26]. Singh and Giri (2001) [22] also concluded that proper weed control was responsible for increase in plant height and dry matter production in Groundnut. It is fact that weed free environment in crop facilitated better peg initiation and development at the critical growth stages of Groundnut which tends to increase in number of pods plant$^{-1}$ and pod yield ha$^{-1}$. Higher profitable pod yield of summer Groundnut was also reported by Raj *et al.* (2008) [18] with keeping the crop in weed free condition. The higher pod yield in Flumioxazin 50% SL 125 g a.i ha$^{-1}$ at 1 DAS or Flumioxazin 50% SL 150 g a.i ha$^{-1}$ at 1 DAS or its higher levels over untreated control treatment might be due to suppression of weed seed germination and seedling development at early stages due to pre-emergent herbicides. Exceptional weeds emerged were removed through effects of these herbicides hence treatments get weed free condition where in weed free check, weeds were removed as and when they emerged from soil. Untreated control gave reduced yield due to presence of weeds and resulted in increased weed competition for growth resources, especially for moisture, nutrients and light. Similar yield reduction due to presence of weeds has been reported by Hiremath *et al.* (1997) [6] and Kori (2000) [9].

**Economics**

All the weed management practices recorded higher net returns and B: C ratio over untreated control table 4. While, among all the treatments highest benefit-cost ratio was obtained with Flumioxazin 50% SL 125 g a.i ha$^{-1}$. This was due to higher pod yield and subsequently lower cost of cultivation (Mene *et al.,* 2003) [13] of Groundnut crop which was increased in treatment weed free check due to the higher need of human labours and their higher wages. That's why gross return was found maximum with weed free check but benefit-cost ratio less than the applying different doses of Flumioxazin. Sasikala *et al.* (2004) [21] and Rao *et al.* (2011) [19] have also reported higher net return and B: C ratio with pre and post emergence application of herbicides. Untreated control recorded lower net returns and B: C ratio and it is quite important to note that keeping the land free of weeds throughout the crop growth period is practically impossible by the farmers, since involves huge cost on labour. Tewari *et al.* (1989) [24] reported that the additional amount of income obtained under weed free appeared to be immaterial when compared to cost of weeding incurred to maintain weed free condition beyond eight weeks after sowing. The availability of working forces in villages has been reduced considerably and availability of required labour force at particular stage of crop growth is also difficult.

**Table 1:** Effect of weed management practices on weed population (no. m$^{-2}$) in summer Groundnut.

| Treatment | 30 DAS | | | 45 DAS | | | 60 DAS | | | At harvest | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grassy | Broad leaves | Sedges | Grassy | Broad leaves | Sedges | Grassy | Broad leaves | Sedges | Grassy | Broad leaves |
| $T_1$ | 1.44 (1.56) | 1.48 (1.69) | 1.68 (2.31) | 2.87 (7.76) | 2.70 (6.77) | 2.08 (3.81) | 4.89 (23.38) | 3.69 (13.09) | 2.21 (4.38) | 3.86 (14.43) | 2.87 (7.76) |
| $T_2$ | 1.39 (1.43) | 1.38 (1.40) | 1.62 (2.12) | 2.66 (6.56) | 2.57 (6.10) | 2.01 (3.53) | 4.68 (21.43) | 3.55 (12.10) | 2.14 (4.08) | 3.98 (15.31) | 2.80 (7.34) |
| $T_3$ | 1.18 (0.88) | 1.25 (1.06) | 1.55 (1.90) | 2.55 (6.56) | 2.42 (5.34) | 1.95 (3.30) | 4.56 (20.29) | 3.43 (11.24) | 2.08 (3.84) | 3.55 (12.10) | 2.36 (5.05) |
| $T_4$ | 1.05 (0.60) | 1.05 (0.60) | 1.49 (1.71) | 1.87 (3.01) | 2.18 (4.25) | 1.89 (3.06) | 3.88 (14.58) | 3.17 (9.53) | 2.02 (3.58) | 2.85 (7.60) | 2.13 (4.02) |
| $T_5$ | 1.48 | 1.44 | 1.74 | 3.01 | 2.81 | 2.08 | 5.03 | 3.79 | 2.28 | 3.99 | 2.97 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1.70) | (1.57) | (2.52) | (8.54) | (7.40) | (3.81) | (24.77) | (13.89) | (4.68) | (15.39) | (8.30) |
| $T_6$ | 1.62 (2.12) | 1.83 (2.85) | 1.80 (2.75) | 3.15 (9.40) | 2.94 (8.16) | 2.14 (4.07) | 5.19 (26.40) | 3.92 (14.87) | 2.30 (4.77) | 4.17 (16.86) | 3.24 (10.00) |
| $T_7$ | 2.09 (3.88) | 2.72 (6.90) | 1.61 (2.08) | 4.23 (17.36) | 4.39 (18.74) | 2.20 (4.35) | 6.25 (38.52) | 5.15 (26.06) | 2.37 (5.12) | 5.21 (26.64) | 4.19 (17.03) |
| $T_8$ | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) |
| S.Em± | 0.07 | 0.10 | 0.14 | 0.19 | 0.18 | 0.14 | 0.18 | 0.14 | 0.21 | 0.22 | 0.15 |
| CD (P=0.05) | 0.24 | 0.30 | 0.41 | 0.58 | 0.54 | 0.41 | 0.56 | 0.43 | 0.64 | 0.64 | 0.45 |
| CV (%) | 9.43 | 11.91 | 15.65 | 12.76 | 12.01 | 12.69 | 7.27 | 7.18 | 18.34 | 10.55 | 9.82 |

$T_1$: Flumioxazin 50% SL 75 g a.i $ha^{-1}$ at 1 DAS, $T_2$: Flumioxazin 50% SL 100 g a.i $ha^{-1}$ at 1 DAS, $T_3$: Flumioxazin 50% SL 125 g a.i $ha^{-1}$ at 1 DAS, $T_4$: Flumioxazin 50% SL 150 g a.i $ha^{-1}$ at 1 DAS, $T_5$: Imazethapyr 10% SL 100 g a.i $ha^{-1}$ at 1 DAS, $T_6$: Pendimethalin 30% EC 750 g a.i $ha^{-1}$ at 1 DAS, $T_7$: Untreated control and $T_8$: Weed free.

**Table 2:** Effect of weed management practices on dry weight of weed (g $m^{-2}$) in summer Groundnut

| Treatment | 30 DAS | | | 45 DAS | | | 60 DAS | | | At harvest | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grassy | Broad leaves | Sedges | Grassy | Broad leaves | Sedges | Grassy | Broad leaves | Sedges | Grassy | Broad leaves |
| $T_1$ | 0.85 (0.23) | 0.93 (0.37) | 0.91 (0.33) | 1.87 (3.01) | 0.97 (0.43) | 1.65 (2.21) | 2.73 (6.95) | 1.26 (1.09) | 1.01 (0.53) | 1.93 (3.22) | 0.91 (0.32) |
| $T_2$ | 0.80 (0.15) | 0.85 (0.22) | 0.84 (0.20) | 1.66 (2.24) | 0.91 (0.33) | 1.63 (2.16) | 2.65 (6.50) | 1.23 (1.02) | 1.00 (0.50) | 1.83 (2.85) | 0.84 (0.21) |
| $T_3$ | 0.78 (0.11) | 0.82 (0.18) | 0.78 (0.11) | 1.55 (1.91) | 0.87 (0.26) | 1.54 (1.88) | 2.55 (6.00) | 1.16 (0.85) | 0.97 (0.45) | 1.77 (2.63) | 0.78 (0.10) |
| $T_4$ | 0.75 (0.06) | 0.73 (0.04) | 0.73 (0.03) | 0.87 (0.26) | 0.79 (0.12) | 1.30 (1.20) | 1.86 (2.96) | 1.10 (0.72) | 0.94 (0.39) | 1.42 (1.52) | 0.74 (0.05) |
| $T_5$ | 0.89 (0.29) | 0.95 (0.41) | 1.02 (0.53) | 2.01 (3.53) | 0.92 (0.35) | 1.56 (1.93) | 3.02 (8.60) | 1.34 (1.30) | 1.04 (0.58) | 1.99 (3.46) | 0.88 (0.27) |
| $T_6$ | 0.95 (0.41) | 1.10 (0.72) | 1.08 (0.67) | 2.15 (4.11) | 0.97 (0.43) | 1.77 (2.64) | 3.14 (9.34) | 1.39 (1.43) | 1.07 0.65) | 2.08 (3.83) | 0.93 (0.37) |
| $T_7$ | 1.17 (0.88) | 1.60 (2.07) | 1.46 (1.62) | 3.23 (9.91) | 1.22 (0.98) | 1.91 (3.14) | 3.68 (13.04) | 1.67 (2.30) | 1.10 (0.71) | 2.60 (6.28) | 1.70 (2.38) |
| $T_8$ | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) | 0.71 (0.00) |
| S.Em± | 0.05 | 0.05 | 0.27 | 0.19 | 0.04 | 0.09 | 0.13 | 0.05 | 0.07 | 0.10 | 0.04 |
| CD (P=0.05) | 0.15 | 0.13 | 0.19 | 0.58 | 0.13 | 0.28 | 0.39 | 0.17 | 0.21 | 0.30 | 0.11 |
| CV (%) | 10.61 | 8.09 | 11.43 | 19.12 | 7.77 | 10.62 | 8.55 | 7.65 | 12.04 | 9.25 | 7.02 |

$T_1$: Flumioxazin 50% SL 75 g a.i $ha^{-1}$ at 1 DAS, $T_2$: Flumioxazin 50% SL 100 g a.i $ha^{-1}$ at 1 DAS, $T_3$: Flumioxazin 50% SL 125 g a.i $ha^{-1}$ at 1 DAS, $T_4$: Flumioxazin 50% SL 150 g a.i $ha^{-1}$ at 1 DAS, $T_5$: Imazethapyr 10% SL 100 g a.i $ha^{-1}$ at 1 DAS, $T_6$: Pendimethalin 30% EC 750 g a.i $ha^{-1}$ at 1 DAS, $T_7$: Untreated control and $T_8$: Weed free.

**Table 3:** Effect of weed management practices on weed control efficiency in summer Groundnut.

| Treatment | 30 DAS | | | 45 DAS | | | 60 DAS | | | At harvest | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grassy | Broad leaves | Sedges | Grassy | Broad leaves | Sedges | Grassy | Broad leaves | Sedges | Grassy | Broad leaves |
| $T_1$ | 73.97 | 81.99 | 79.77 | 69.64 | 55.68 | 29.47 | 46.79 | 52.71 | 38.02 | 48.63 | 86.46 |
| $T_2$ | 83.42 | 89.53 | 87.67 | 77.35 | 65.91 | 31.21 | 50.22 | 55.60 | 41.18 | 54.62 | 91.36 |
| $T_3$ | 87.64 | 91.41 | 93.00 | 80.70 | 73.20 | 39.98 | 54.06 | 62.90 | 47.37 | 58.06 | 95.66 |
| $T_4$ | 93.44 | 98.18 | 98.27 | 97.35 | 87.88 | 61.77 | 77.35 | 68.81 | 54.13 | 75.84 | 97.79 |
| $T_5$ | 67.36 | 80.26 | 67.10 | 64.42 | 64.04 | 38.33 | 34.18 | 43.67 | 31.58 | 44.88 | 88.71 |
| $T_6$ | 53.37 | 65.36 | 58.47 | 58.55 | 55.68 | 15.65 | 28.53 | 37.71 | 23.29 | 39.04 | 84.40 |
| $T_7$ | 0.00 | 0.00 | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| $T_8$ | 100.00 | 100 | 100.00 | 100.00 | 100 | 100.00 | 100.00 | 100 | 100.00 | 100.00 | 100 |

$T_1$: Flumioxazin 50% SL 75 g a.i $ha^{-1}$ at 1 DAS, $T_2$: Flumioxazin 50% SL 100 g a.i $ha^{-1}$ at 1 DAS, $T_3$: Flumioxazin 50% SL 125 g a.i $ha^{-1}$ at 1 DAS, $T_4$: Flumioxazin 50% SL 150 g a.i $ha^{-1}$ at 1 DAS, $T_5$: Imazethapyr 10% SL 100 g a.i $ha^{-1}$ at 1 DAS, $T_6$: Pendimethalin 30% EC 750 g a.i $ha^{-1}$ at 1 DAS, $T_7$: Untreated control and $T_8$: Weed free.

**Table 4:** Effect of weed management practices on yield of summer Groundnut

| Treatments | Pod yield (kg $ha^{-1}$) | Haulm yield (Kg $ha^{-1}$) | Harvest index (%) | Shelling (%) | Weed Index (%) | Cost of Cultivation (₹ $ha^{-1}$) | Gross return (₹ $ha^{-1}$) | Net return (₹ $ha^{-1}$) | B: C Ratio |
|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | 2087.00 | 2544.12 | 45.02 | 61.27 | 40.19 | 34408 | 100176 | 65768 | 1.90 |
| $T_2$ | 2576.00 | 2743.80 | 48.39 | 63.80 | 26.18 | 34408 | 123648 | 89240 | 2.34 |
| $T_3$ | 2991.02 | 2949.18 | 50.35 | 65.70 | 14.28 | 34408 | 143569 | 109161 | 3.22 |
| $T_4$ | 3199.33 | 3155.73 | 50.37 | 71.00 | 8.31 | 34408 | 153568 | 119160 | 3.19 |
| $T_5$ | 2078.43 | 2746.97 | 42.69 | 65.27 | 40.43 | 34368 | 99765 | 65397 | 1.88 |
| $T_6$ | 2033.00 | 2722.81 | 42.82 | 62.13 | 41.74 | 34363 | 97584 | 63221 | 1.61 |
| $T_7$ | 901.50 | 1890.04 | 32.57 | 60.00 | 73.91 | 33388 | 43704 | 10316 | 0.19 |
| $T_8$ | 3489.33 | 3509.54 | 49.85 | 72.67 | 0.00 | 51388 | 167488 | 116100 | 2.13 |
| S.Em± | 100.15 | 122.98 | 1.93 | 2.68 | - | - | 4807 | 4807 | 1.90 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CD (P=0.05) | 303.77 | 362.80 | 5.89 | 8.11 | - | - | 14580 | 14580 | 2.34 |
| CV (%) | 7.17 | 7.66 | 7.39 | 7.11 | | - | 7.17 | 10.43 | 3.22 |

$T_1$: Flumioxazin 50% SL 75 g a.i $ha^{-1}$ at 1 DAS, $T_2$: Flumioxazin 50% SL 100 g a.i $ha^{-1}$ at 1 DAS, $T_3$: Flumioxazin 50% SL 125 g a.i $ha^{-1}$ at 1 DAS, $T_4$: Flumioxazin 50% SL 150 g a.i $ha^{-1}$ at 1 DAS, $T_5$: Imazethapyr 10% SL 100 g a.i $ha^{-1}$ at 1 DAS, $T_6$: Pendimethalin 30% EC 750 g a.i $ha^{-1}$ at 1 DAS, $T_7$: Untreated control and $T_8$: Weed free.

## Conclusion

To conclude from the above findings, it can be stated that Flumioxazin 50% SL 125 g a.i $ha^{-1}$ at 1 DAS can effectively managing broad-spectrum weeds and cost effective weed management practices in Groundnut in lateritic belt of West Bengal.

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