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Effect of Some Dinitroaniline Herbicides on Growth, Nodulation, Chlorophyll Content and Nitrate Reductase Activity of Urdbean [*Vigna mungo* (L.) Hepper] Crop

Ram Murti, A. K. Khan, R. D. Vaishya and Pankaj Kumar Yadav
Department of Crop Physiology
N. D. University of Agriculture & Technology, Kumarganj, Faizabad-224 229 (U. P.), India

Urdbean [*Vigna mungo* (L.) Hepper] is a short duration crop grown during **kharif** season in north India. Herbicides' use to control weeds forms a part of modern agricultural production system and, therefore, contributes significantly to the economy of agricultural production. The herbicides are economical and their use is increasing day by day. Dinitroaniline herbicides such as pendimethalin and fluchloralin are widely used to control weeds in pulses (Mishra and Singh, 1993; Balyan *et al.*, 1997). Besides providing good control of weeds, these herbicides may also affect the growth and other physiological parameters of the crops in which the herbicide is applied due to their toxic nature. Hence, an attempt has been made to study whether, and to what extent, the recommended herbicides influence the growth, nodulations, chlorophyll content and nitrate reductase activity of urdbean.

A field experiment was conducted at Instructional Farm, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U. P.) during **kharif** season of 2000. The soil was sandy loam in texture (pH 7.6). The experiment was laid out in randomized block design with four replications. The seeds of urdbean (cv. Type-9) were sown in lines. Fluchloralin was incorporated into the soil before sowing at 0.75, 1.0 and 1.25 kg ha^{-1}, while pendimethalin was applied on soil surface after sowing and before germination at 0.75, 1.0 and 1.25 kg ha^{-1}. Herbicides were sprayed with the help of a manual operated knapsack sprayer fitted with flat fan nozzle using 500 l water ha^{-1}. Water sprayed plots served as control. All the plots were kept weed-free throughout the growing season to avoid crop-weed competition. Plant to plant distance was maintained by thinning at 15 DAS. Five tagged plants were

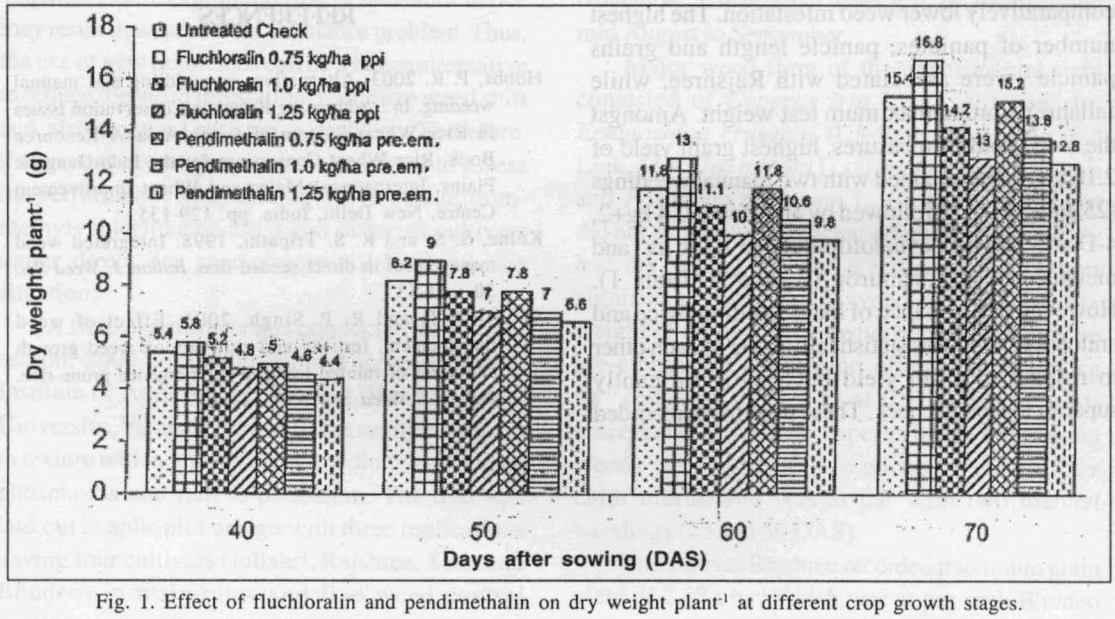

Fig. 1. Effect of fluchloralin and pendimethalin on dry weight plant^{-1} at different crop growth stages.

randomly uprooted from each plot with the help of *khurpi* at each stage of observation i. e. at 40, 50, 60 and 70 DAS. The maximum care was taken to keep the nodules intact with the roots while removing the plants from the soil. After that, roots of the plants were washed gently with tap water. Number of nodules and their fresh as well as dry weights, leaf area and dry weight of plant were recorded. The leaf area of all the plants was recorded with the help of leaf area meter (LICOR-USA model L1-3000) at each sampling date.

Dry Matter (g Plant^{-1})

Dinitroaniline herbicides significantly influenced the dry matter production per plant and maximum values of dry matter were recorded under the effect of fluchloralin applied at 0.75 kg ha^{-1} at all the crop growth stages (Fig. 1). This was due to more vegetative growth of crop as evident by higher number of branches per plant under the effect of fluchloralin at 0.75 kg ha^{-1}. However, pendimethalin applied at 0.75 kg ha^{-1} significantly reduced the dry matter per plant at 40 and 50 days after sowing.

While the effect was not very detrimental at later stages and produced dry matter at par with untreated check. Higher doses (1.0 and 1.25 kg ha^{-1}) of both the herbicides registered significant decrease in dry matter production over untreated check except in fluchloralin 1.0 kg ha^{-1} at 40 days after sowing. The effect of pendimethalin was found more detrimental on dry matter production than fluchloralin.

Leaf Area Plant^{-1} (cm^2)

Leaf area per plant progressively increased upto 60 days after sowing but at 70-day stage, reduction in leaf area per plant was observed in all the treatments over untreated check (Fig. 2). The reduction in leaf area at 70-day stage was due to senescence in older leaves. Application of fluchloralin at 0.75 kg ha^{-1} significantly increased leaf area per plant over untreated check, while its higher doses (1.0 and 1.25 kg ha^{-1}) caused significant reduction in leaf area in comparison to untreated check. All the doses (0.75, 1.0 and 1.25 kg ha^{-1}) of pendimethalin significantly reduced leaf area as compared with untreated check at all the growth stages.

Number of Nodules and their Fresh and Dry Weight Plant^{-1}

Number of nodules and their fresh and dry weight per plant increased upto 50 days after sowing

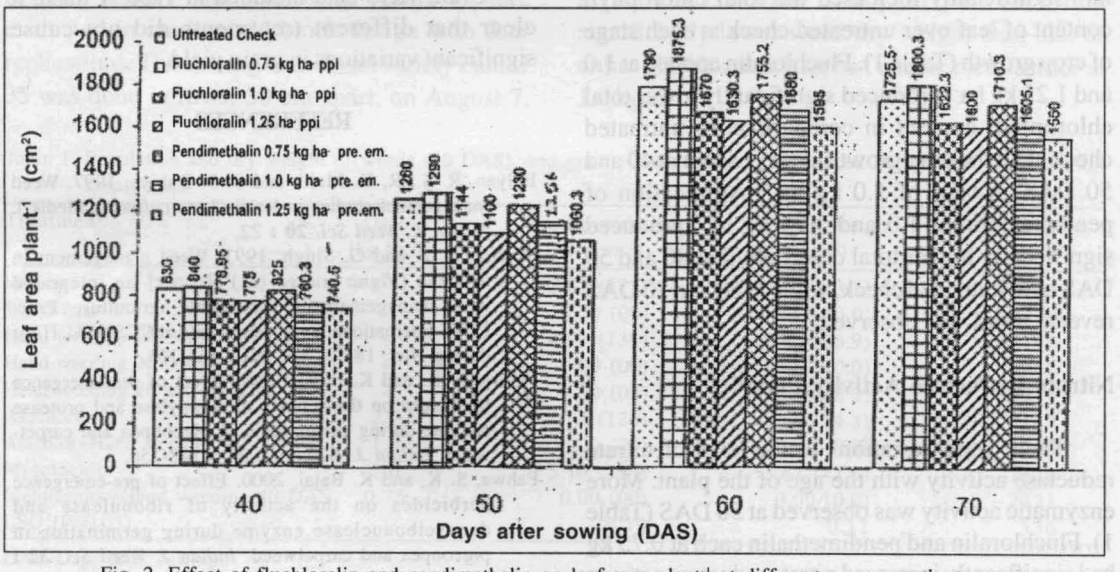

Fig. 2. Effect of fluchloralin and pendimethalin on leaf area plant^{-1} at different crop growth stages.

Table 1. Effect of fluchloralin and pendimethalin on number of nodules and their fresh and dry weight, chlorophyll content and enzyme nitrate reductase activity at 70th day stage of growth and grain yield of urdbean

Treatment	Dose (kg ha^{-1})	No. of nodules plant^{-1}	Fresh wt. of nodules (mg plant^{-1})	Dry wt. of nodules (mg plant^{-1})	Total chlorophyll (mg g^{-1} fresh wt.)	NR activity μ moles nitrate produced g^{-1} fresh wt. h^{-1}	Grain yield (g plant^{-1})
Untreated check	-	9.0	175	13.7	2.8	17.1	10.2
Fluchloralin as ppi	0.75	9.3	190	14.0	3.0	22.7	10.3
Fluchloralin as ppi	1.00	8.2	169	13.5	2.5	20.2	10.1
Fluchloralin as ppi	1.25	8.1	168	14.0	2.0	15.0	9.7
Pendimethalin as pre-em.	0.75	9.2	180	14.0	2.9	21.5	10.2
Pendimethalin as pre-em.	1.00	9.0	165	13.6	2.5	19.0	10.0
Pendimethalin as pre-em.	1.25	8.0	163	13.5	2.3	15.0	9.7
LSD (P=0.05)	-	NS	5	NS	0.2	3.1	NS

NS–Not Significant.

and thereafter it declined with increasing plant age (Table 1). Fluchloralin at 0.75 kg ha^{-1} recorded significantly higher number of nodules per plant at all the crop growth stages. However, the effect of fluchloralin at 1.0 and 1.25 kg ha^{-1} as well as pendimethalin at 0.75 and 1.0 kg ha^{-1} produced nodule number at par with untreated check, while at 1.25 kg ha^{-1} reduction was significant.

Chlorophyll Content Plant^{-1} (mg g^{-1})

Pendimethalin and fluchloralin each at 0.75 kg ha^{-1} significantly increased the total chlorophyll content of leaf over untreated check at each stage of crop growth (Table 1). Fluchloralin applied at 1.0 and 1.25 kg ha^{-1} produced significantly lower total chlorophyll content in comparison to untreated check at all the crop growth stages except at 40 and 50 DAS in case of 1.0 kg ha^{-1}. Application of pendimethalin at 1.0 and 1.25 kg ha^{-1} produced significantly higher total chlorophyll at 40 and 50 DAS over untreated check, while at 60 and 70 DAS reverse trend was observed.

Nitrate Reductase Activity Plant^{-1}

There were variations in the level of nitrate reductase activity with the age of the plant. More enzymatic activity was observed at 50 DAS (Table 1). Fluchloralin and pendimethalin each at 0.75 kg ha^{-1} significantly increased nitrate reductase activity at all the crop growth stages over untreated check. Fluchloralin registered maximum increase in nitrate reductase activity. Pahwa and Bajaj (1999) found reduction in the activity of α-amylase and proteases in pigeonpea and carpetweed by the application of pendimethalin and trifluralin. Pahwa and Bajaj (2000) reported reduction in activity of R-Nase and D-Nase by the application of pendimethalin and fluchloralin.

Grain Yield (g Plant^{-1})

Grain yield data included in Table 1 make it clear that different treatments did not cause significant variations in grain yield.

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