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Bioassay of Pendimethalin at Different Moisture Levels in Wheat for Controlling *Polygonum*

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The *terai* agro-climatic region of West Bengal has a characteristic of typical sub-tropical humid climate. Aggressive growth of weeds especially from several species *Polygonum (Polygonum pensylvanicum, P. orientale, P. persicaria*) offered strong competition to the crops grown during the **rabi** season. Multiple nutrient deficiencies owing to coarse texture soil and high rainfall during the rainy season as well as high invasion of *Polygonum* become the major constraint in crop cultivation during the **rabi** season. Moreover, in sandy loam soil, pre-emergence application of pendimethalin often shows phytotoxicity to wheat plant in theses areas. Keeping this view in mind, an attempt has been made to work out the dose of pendimethalin in wheat for controlling *Polygonum* and to determine value of selectivity index at different moisture levels through bioassay technique. A field experiment was carried out during the **rabi** season of 2008 in the farm of Uttar Banga Krishi Viswavidyalaya. The cultivated wheat variety PBW-343 was used in the experiment. The soil of the experimental site was sandy loam in character with pH 5.42-5.8, organic carbon 0.45%, available nitrogen 110.50 kg/ha, available phosphorus 16.10 kg/ha and available potassium 77.40 kg/ha. In wheat, pendimethalin with the dose of 0, 0.30, 0.50, 0.60, 0.70, 0.80, 0.90, 1.00 and 1.20 kg/ha was used in the field experiment having the plot size of 2 sq m area at different moisture levels (33.92, 24.64 and 18.46%). In *Polygonum* sp., pendimethalin doses of 0, 0.05, 0.10, 0.15, 0.20, 0.25, 0.30, 0.35, 0.40, 0.45 and 0.50 kg/ha were used. Visual observations were made everyday to understand the changes in growth behaviour of the plants and appearance of phytotoxic symptom owing to herbicidal toxicity on plant at different doses. Both wheat and weed plant samples were taken at 25 days after sowing from 50 x 50 cm sample area. Biological response of plants to herbicides was determined by measuring the dry weight of the plants grown in herbicide treated soil with different doses and per cent growth inhibition of plant was calculated by comparing the dry weight of herbicide treated plant with healthy plant from untreated plot. The per cent growth inhibition values obtained at different herbicidal doses both in case of wheat and weed were transformed to probit values and regressed against log values of doses. The linear regression equation was computed by using excel programme Y=bx+a, where Y indicates probit value of % dry weight reduction, b is regression coefficient, x is log dose of herbicide and a is intercept of Y. Selectivity index (S. I.) value was calculated by using the following formula :

$$\text{Selectivity index} = \frac{\text{Maximum dose tolerated by crop (wheat)}}{\text{Minimum dose required to control the weed (}\textit{Polygonum}\text{)}}$$

Maximum dose of herbicide tolerated by wheat crop was equal to the dose that caused 10% growth reduction of wheat (GR_{10}) at initial stages and minimum dose required to control the weeds (*Polygonum*) was equal to the dose that resulted in 80% growth reduction of weed (GR_{80}) or 80% weed control efficiency of herbicide. Selectivity index value greater than 1 is always desirable to get selective control over weeds without any lethal effect on crop plant. The proportional increase of plant response in terms of growth reduction to herbicidal doses led to identify the level at which the plant produced 50% response which is known as GR_{50} (dose of herbicide that led to 50% growth reduction).

Calculation

For wheat crop at 33.92% moisture level

GR_{10}

$Y = 4.236X + 4.9686$ and $R^2 = 0.7498$

Calculation of GR_{10}

Y= Probit value of 10% growth reduction of wheat i. e. 3.7184

$3.7184 = 4.236x + 4.9686$

Then $x = -0.295$

Anti log of -0.295 = 0.506, then GR_{10}= 0.506 kg/ha dose of pendimethalin….....…(i)

Calculation of GR_{50}

Table 1. Dose of pendimethalin and its selectivity index at different moisture levels

Moisture (%)	Maximum dose (kg/ha) tolerated by crop (GR_{10})	Minimum dose (kg/ha) required to control the *Polygonum* (GR_{80})	Selectivity index	GR_{50} value (kg/ha)	Linear regression equation	R^2 value
33.92	0.51		2.048	1.02	Y=4.236x+4.9686	0.75
24.64	0.45		1.838	0.91	Y=4.2929x+5.1869	0.86
18.46	0.4		1.607	0.81	Y=4.107x+5.368	0.95
Polygonum and pendimethalin		0.247		0.17	Y=5.423x+9.133	0.78

Y=Probit value of 50% growth reduction of wheat i. e. 5.00

5.00 = 4.236x + 4.9686

Then, $x = 7.412 \times 10^{-3}$

Anti log of 7.412×10^{-3}=1.2 then GR_{50}= 1.2 kg/ha dose of pendimethalin

For wheat crop at 24.64% moisture level

GR_{10}

Y= 4.2929x + 5.1869

3.7184= 4.2929x + 5.1869

Then x= - 0.3420

Anti log of - 0.3420= 0.454 then GR_{10}= 0.454 kg/ha dose of pendimethalin

GR_{50}

Y=4.2929x + 5.1869

5.00=4.2929x + 5.1869 then x= -0.043

Anti log of -0.043= 0.905 then GR_{50}= 0.905 kg/ha dose of pendimethalin

For wheat crop at 18.46% moisture level

GR_{10}

Y= 4.107x + 5.368

3.7184= 4.107x + 5.368 then x= -0.401

Anti log of -0.401= 0.397 then GR_{10}= 0.397 kg/ha dose of pendimethalin

GR_{50}

Y=4.107x + 5.368

5.00=4.107x + 5.368 then x= -0.089

Anti log of -0.089= 0.814 then GR_{50}= 0.814 kg/ha dose of pendimethalin

For weed (*Polygonum* sp.)

GR_{80}

Y= 5.423x + 9.1328

5.8416= 5.423x + 9.1328

or, x =-0.606

Anti log -0.606= 0.247, then GR_{80}= 0.247 kg/ha dose of pendimethalin….....(ii)

$$SI = \frac{GR_{10} \text{ value of pendimethalin for wheat}}{GR_{80} \text{ value of pendimethalin for weed}}$$

SI=0.506/0.247=2.0486 at 33.92% moisture level

SI=0.454/0.247=1.838 at 24.64% moisture level

SI=0.397/0.247=1.607 at 18.46% moisture level

Data in Table 1 reveal that maximum dose of pendimethalin tolerated by the wheat crop and its selectivity index value increased with increased moisture level. Maximum dose of pendimethalin in wheat varied from 0.5 to 0.40 kg/ha depending upon the moisture levels.

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