



Efficacy of 2, 4-D Herbicide Application on Growth, Yield and Spike Deformities in Late Sown Wheat Varieties in Eastern Uttar Pradesh

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Field experiments were conducted to study the efficacy of 2, 4-D application on growth and yield in late sown wheat varieties under eastern U.P. condition during *rabi* 2007-08 and 2008-09. Results clearly revealed that density of broad leaf weeds as well their biomass production were significantly lesser with application of 2, 4-D at 25 DAS. However, the herbicide 2, 4-D application at 25 and 45 DAS significantly reduced the growth and yield attributes such as plant height, dry matter, leaf area index, no. of tillers, spike length, no. of grain spike⁻¹ and test weight. Weed free treatment recorded significantly higher growth, yield contributing characters and yield which was at par with application of 2, 4-D at 35 DAS. Wheat variety HUW-234 recorded significantly higher values of growth, yield attributes and yield as compared the other varieties. Application of 2, 4-D at 25 DAS recorded spike deformities in comparison to remaining stages in wheat variety PBW-373.

Key words: 2, 4-D, Spike deformities, Tillers, Dry matter and, Yield

Wheat (*Triticum aestivum* L.) is the world most important crop both with respect to area (215 m ha) and production (650.9 mt) (FAO, 2010). Among the food crops, wheat is one of the most important crops with abundant sources of energy and proteins for the world population and its increased production is essential for food security. Although the environmental condition is favourable and high yielding varieties are available in the country, we could achieve its potential yield yet the productivity of wheat in Eastern U.P. is very low which might be due to late sowing, improper selection of suitable wheat varieties as well as improper weed management. Among these factors, infestation of weeds is a serious issue and requires immediate attention. Significant reduction in wheat yield ranging from 18-73% due to severe infestation of weeds has been reported by Pandey and Verma (2004). The herbicide 2,4-D, a selective herbicide has been used in crop field quite for long time and used to kill broadleaf weeds with little harm to grass crops. It is a plant growth regulator and mimics the natural plant growth hormone, auxin. Unlike auxins, 2, 4-D stay at high levels within plant tissue rather than fluctuation. As a result, it causes rapid cell growth and plants die when their transport systems become blocked and destroyed by abnormally fast growth (Hess 1993).

While 2, 4-D is normally applied to a plants leaves, it can also be absorbed through the roots and stems. In India 2, 4-D herbicide is one of the recommended and widely used herbicides for weed

control in wheat. 2, 4-D is stage specific herbicide and even tolerant cereal crops like wheat, barley and oat are very sensitive to 2,4-D when applied at germination and seedling stage (Kumar and Singh, 2010). Therefore, in view of the importance of the problems from the national point, the present research work was conducted to study the efficacy of 2,4-D herbicide application on growth, yield and spike deformities in late sown wheat varieties under eastern Uttar Pradesh condition.

Materials and Methods

Field experiments were conducted during *rabi* 2007-08 and 2008-09 at Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad U.P. The soil of experimental site was silt loam, slightly alkaline in reaction (pH 7.9), low in organic carbon (0.32%), available nitrogen (180 kg ha⁻¹), available phosphorus (8 kg ha⁻¹) and medium in available potassium (210 kg ha⁻¹). The experiment was laid out in split plot design consisting 24 treatment combinations and was replicated thrice. The experiment comprised 4 times of herbicidal application of 2, 4-D viz, 25, 35 and 45 DAS along with control were fitted in main plot and six wheat varieties viz, PBW-373, NW-2036, HUW-234, K-7903, Raj-3077 and Raj-3765 were allocated to sub-plot. The 2, 4-D amine salt was applied as per treatment @ 0.5 kg ha⁻¹ with the help of manually operated knapsack sprayer fitted with flatfan nozzle using 800 litres of water ha⁻¹. Sowing was done on 25th Dec 2007 and 30th Dec 2008 during the

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respective year all the recommended package of practices were followed. All the herbicides were applied as post emergence and data were recorded on the following parameters of growth, yield attributes and yield viz, plant height, no. of tillers, dry matter, leaf area meter, spike length, no. of grain spike⁻¹, 1000-grain weight, grain, straw, biological yields and harvest index were recorded as per standard procedures to draw valuable conclusion by applying the standard procedure of analysis of variance.

Results and Discussion

Weed studies

It was evident from the data, that time of application of 2, 4-D had significant effect on broad

Table 1. Effect of time of application of 2, 4-D on growth characters of wheat varieties (Mean data of 2 years)

Treatment	Plant height (cm)	Tillers/m row (No.)	Dry matter accumulation (g/m row)	Leaf area index
Time of application of 2,4-D.				
25 th day	86.91	80.10	168.0	3.29
35 th day	92.55	82.73	184.9	3.54
45 th day	90.97	78.12	171.1	3.43
Weed free	94.96	84.72	192.3	3.57
SEm [±]	1.23	1.35	2.8	0.05
CD(P=0.05)	3.96	NS	9.2	0.16
Varieties				
PBW-373	83.28	77.95	164.6	3.31
NW-2036	91.91	83.05	189.7	3.51
HUW-234	95.80	84.88	194.4	3.65
K-7903	88.03	80.82	176.5	3.42
Raj-3077	89.42	82.27	181.3	3.47
Raj-3765	87.00	79.52	167.9	3.38
SEm [±]	1.66	1.51	3.4	0.05
CD (P=0.05)	4.76	4.33	9.8	0.15

leaf weeds (fig. 1). Weed density (19.32) and dry weight of weed (2.87 g m⁻²) decreased significantly

when 2,4-D was applied at 25 DAS but other weed species like grasses and sedges were not affected significantly. In relation to different varieties, weed density and dry weight (g m⁻²) were not affected significantly. Similar results were also reported by Bhan and Maurya (1971).

Crop growth characters

Time of application of 2, 4-D significantly affected the growth characters (Table 1) except no. of tillers (m⁻¹ row length). Better growth characters viz, no. of tillers (84.72 m⁻¹ row length), plant height (94.96 cm), dry matter accumulation (192.39 g m⁻¹) and leaf area index (3.57) were recorded under control (weed free) followed by 2,4-D applied at 35 DAS. Wheat variety HUW-234 was recorded significantly higher no. of tillers (84.88 m⁻¹ row), plant height (97.97 cm), dry matter accumulation (194.43 g m⁻¹) and leaf area index (3.65) while variety NW-2039 was statistically at par with HUW-234. The highest growth character is due to minimum weed population. Kumar and Singh (2010) reported that the inferior growth might due to the fact that when 2, 4-D applied at early stage they inhibit cell division and growth, usually in meristematic region.

Yield attributes and Yield

The yield contributing characters and yield except the no. of effective shoots (m⁻¹ row length) (Table 2) were significantly influenced by time of 2, 4-D application Weed free (control) treatment recorded significantly higher spike length (8.55 cm), no. of grains spike⁻¹ (29.27), test weight (39.59 g), grain yield (40.66 qha⁻¹), straw yield (52.79 qha⁻¹) and biological yield (93.45 qha⁻¹) in comparison to 2,4-D application at 25 and 45 DAS. Application of 2, 4-D at 35 DAS was at par with weed free, due to low degree of crop weed competition for light, moisture, nutrients and space. Similar finding were also

Table 2. Effect of time of application of 2, 4-D on yield attributing characters and yield of wheat varieties (Mean data of 2 years).

Treatment	Effective tillers/m (no.)	Spike length (cm)	Grains / spike (no.)	1000-grain wt. (g)	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
Time of application of 2,4-D.								
25 th day	77.10	6.05	23.02	30.10	29.39	47.65	77.04	38.14.
35 th day	79.43	8.10	27.61	37.22	38.60	51.09	89.69	43.03
45 th day	76.33	7.40	26.61	35.05	32.85	49.33	82.18	39.97
Weed free	80.72	8.55	29.27	39.59	40.66	52.79	93.45	43.44
SEm [±]	1.23	0.11	0.55	0.65	0.85	0.87	1.61	—
CD(P=0.05)	NS	0.36	1.77	2.08	2.72	2.78	5.14	—
Varieties								
PBW-373	74.83	6.03	23.39	31.99	29.81	47.56	77.49	38.46
NW-2036	80.33	8.39	28.66	37.78	38.90	52.05	90.95	42.77
HUW-234	81.85	8.83	29.72	38.87	40.03	52.83	92.86	43.10
K-7903	77.21	7.25	26.00	36.51	34.82	49.97	84.79	41.06
Raj-3077	79.27	7.73	26.78	37.18	37.33	51.21	88.54	42.16
Raj-3765	76.57	7.00	25.19	34.61	31.37	47.68	78.93	39.14
SEm [±]	1.42	0.15	0.80	0.79	1.10	1.35	2.19	—
CD (P=0.05)	4.26	0.53	2.20	2.28	3.14	3.85	6.28	—

reported by Kumar *et al.* (2010). Significantly lower yield contributing characters and yields viz- spike length (6.05 cm), no. of grains spike⁻¹ (23.02), test weight (30.10 g), grain yield (29.39 qha⁻¹), straw yield (47.65 qha⁻¹) and biological yield (77.04 qha⁻¹) was

recorded in 2,4-D applied at 25 DAS. The reduction in yield attributes and yield is due to spike deformities, incomplete spike emergence and same time more no. grains formed in cluster at one place on the shortened rachis. This is also reported by Khan *et al.* (2003).

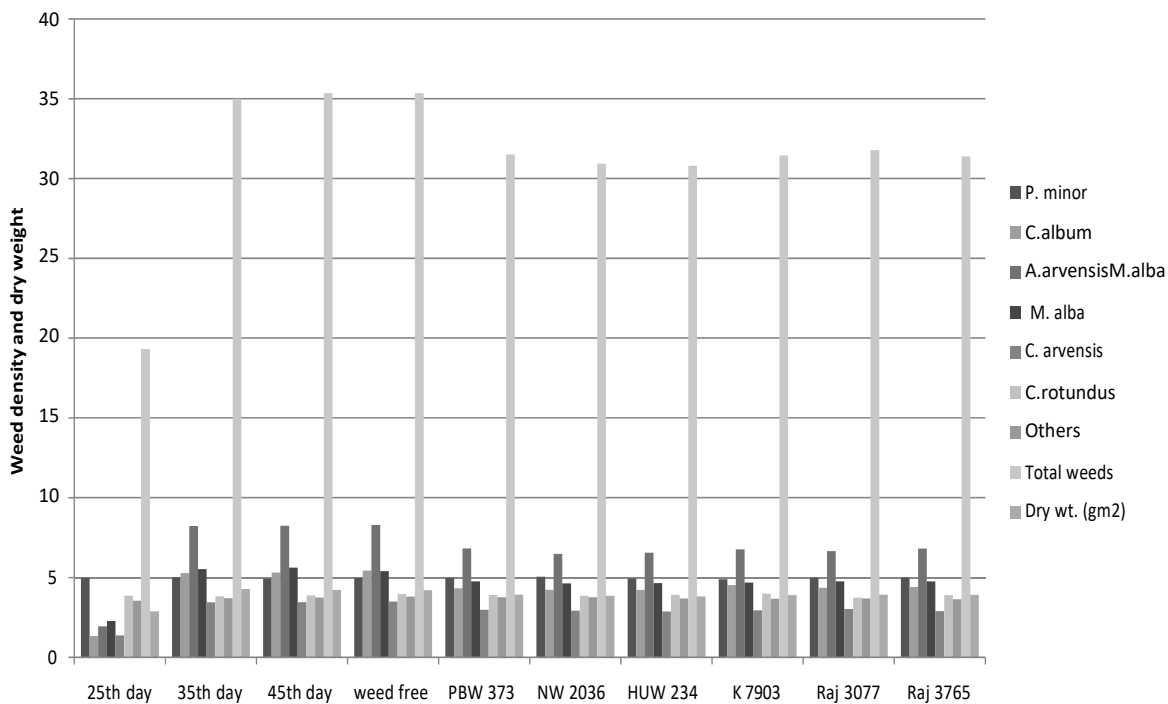


Fig. 1. Effect of time of application of 2, 4-D and varieties on weed density (species wise) and dry weight (gm⁻²) at 35 DAS

Wheat varieties also significantly influenced the yield contributing characters and yields. Wheat variety HUW-234 recorded higher no. of effective shoots m⁻¹ row length (81.85), spike length (8.83

cm), no. of grains spike⁻¹ (29.72), 1000-grain weight (38.87 g), grain yield (40.03 qha⁻¹), straw yield (52.83 qha⁻¹) and biological yield (92.86 qha⁻¹) as compared to other varieties. However, wheat varieties such as

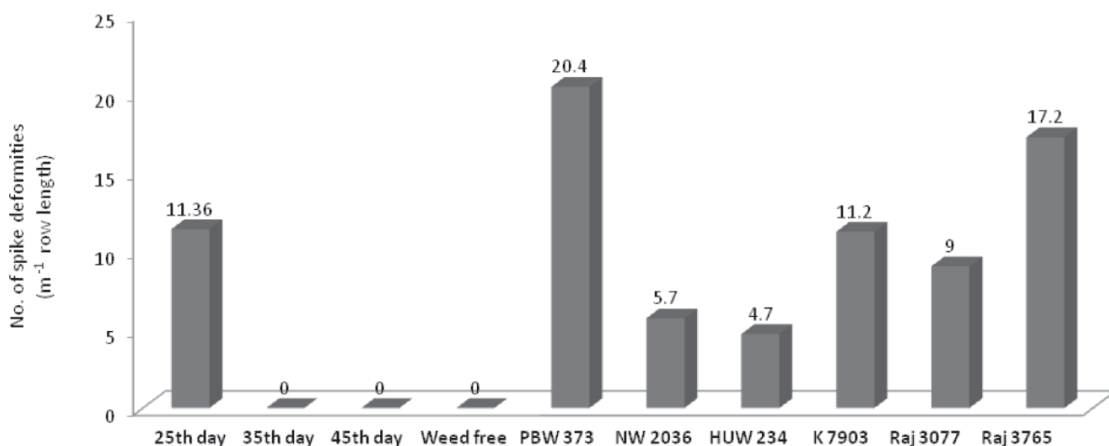


Fig. 2. Effect of time of application of 2, 4-D on spike deformities of wheat

HUW-234, NW-2036 and Raj-3077 were at par with each other and superior over the varieties PBW-373, Raj-3765 and K-7903. This might be due to genetic characters of the varieties Petroczi *et al.*, (2002).

Spike deformities

Application of 2, 4-D at early stage cause spike deformities in comparison to other stages(Fig.2). Significantly higher spike deformities were recorded

in 2,4-D applied at 25 DAS (11.36 m⁻¹ row length) as compared to rest of the stages because 2,4-D has modified the micro tubular assemblies in mitosis, apart from the malfunctioning of the mitotic division spindle poles producing different chromosomal abnormalities that result unsuitable, uncontrolled growth of spike. Similar findings reported by Cox (2005) and Kumar *et al.*, (2010). Wheat varieties PBW-373, Raj-3765 and K-7903 were at par with each other in respect of spike deformities and the highest spike deformities was noticed in PBW-373 (20.4 m⁻¹ row length) Bhan and Maurya (1971).

Based on the outcome of the investigation, it could be inferred that density of broad leaf weeds as well as their biomass production were significantly less with the application of 2,4-D herbicide at 25 DAS. Application of 2, 4-D at 25 and 45 DAS stages significantly reduced the growth, yield attributes and yield. Wheat variety HUW-234 recorded significantly growth, yield attributes and yield. Hence, it may recommend for further cultivation to set better results under late sown condition in eastern U.P. during *rabi* season.

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