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EFFICACY OF HERBICIDES PANIDA 33 EC (PENDIMETHALIN) AND NEON 70 WG (METRIBUZIN) IN POTATO FIELDS

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ABSTRACT

A field experiment was conducted at On-farm research station, Rangpur, BARI during rabi season of 2005-06 and 2006-07 to find out the optimum rate of herbicides and time of application against weeds in potato fields. Herbicides Panida 33 EC (pendimethalin) and Neon 70 WG (metribuzin) were evaluated through post planting pre-emergence and post emergence (9 days after planting) spraying with different rates on weed management in potato fields. Post planting post emergence spraying of Panida 33 ECC and Neon 70 WP controlled all broad leaf weeds. Among the different rates of herbicides Panida 33 EC @ 1.0 up to 3.0 liter and Neon 70 WG @ 750 up to 1000g ha^{-1} showed similar results in controlling broad leaf weeds particularly of *Chenopodium album* (Bathua), *Amaranthus viridis* (Shaknotey), *Alternanthera philoxeroides* (Maloncho), *Lindernia anagallis* (Panigas), *Gnaphalium affine* (Bonocopy), *Oxalis europea* (Amrul) and *Glinus lotoides* (Carpet agacha). Yield of potato tubers in the year 2005-06 was significantly increased up to 51 and 49 % over control by spraying Panida 33 EC @ 3.0 liter and Neon 70 WG @ 1000 g ha^{-1}, respectively at 9 DAP. Similar result was also observed by spraying Panida 33 EC @ 1.0 liter and Neon 70 WG @ 750 g ha^{-1}. In the year 2005-06, the highest tuber yield (21.24 t ha^{-1}) was recorded from weed free plot which was statistically similar with post emergence Panida 33 EC @ 1 l ha^{-1} (19.00 t ha^{-1}) and post emergence neon 70 WG @ 750 g ha^{-1} (20.16 t ha^{-1}). Similar trend was also observed in next year. Post planting post emergence (9 DAP) spraying of Panida 33 EC @ 1.0 l ha^{-1} and Neon 70 EC @ 750 g ha^{-1} in potato fields are most effective in controlling broad leaf weeds like *Chenopodium album*, *Amaranthus viridis*, *Alternanthera philoxeroides*, *Gnaphalum affine*, *Oxalis europea* and *Glinus lotoides*.

Key words: Potato, weed, herbicide, pendimethalin, metribuzin.

INTRODUCTION

Potato is one of the major crops cultivated during rabi season as popular vegetable. Potato (*Solanum tuberosum* L.) belonging to the family Solanaceae is a herbaceous tuber crop. It is indigenous to the central Andean area of South America (Keeps, 1979) and introduced to the Indian sub-continent sometime during the first half of the 17th century (Hashem, 1990). Potato is the 3rd most important crop of Bangladesh, followed by rice and wheat (Illias, 1998). According to BBS (2000), the average yield of potato in Bangladesh is 11.39 t ha^{-1}; which is too low in comparison to that of some potato growing countries of the world (FAO, 1998). Weed is one of the major constraints of potato production in some potato growing areas of our country. Weeds emerge with crop and grow vigorously. Weeds compete with crop for soil moisture, nutrient and also sunlight. The weed species *Coronopus didymus*, *Chenopodium album*, *Fumaria parviflora*, *Melilotus indica* and *Spergula arvensis* competed severely with potato while the competition by other species was normal and the reduction in tuber yield due to weed competition was 63.4% (Pandey, 2001). Farmers are controlling weeds by hand. It takes more time and labour which leads to more expenses. Some herbicides have the capability to reduce weed growth. Pre-emergence herbicide significantly influenced to weed reduction and produced 10% higher tuber yield of potato than the herbicide free plot (Divis, 2002). Metribuzin showed 81 to 95

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percent weed control in potato (Bailey *et al.* 2001). Pendimethalin inhibited the germination of *Chenopodium album*, gave good control of *S. arvensis* and lowered the density of other weed species (Pandey, 2001). But optimum rate of herbicides and time of application is not known. So, the present experiment was undertaken to find out the optimum rate of herbicides and their time of application against the weeds in potato fields.

MATERIALS AND METHODS

The experiment was conducted at On-farm research station, Rangpur, BARI during rabi season of 2005-2006 and 2006-07. Herbicides Panida 33 EC (Pendimethalin) and Neon 70 WG (Metribuzin) were evaluated through post planting pre-emergence and post emergence (9 days after planting) sprayed with different doses on weed management in potato fields. The treatments were (i) Control (no weed management), (ii) pre-emergence Panida 33 EC @ 3.0 lha^{-1}, (iii) post-emergence Panida 33 EC @ 3.0 lha^{-1}, iv) pre-emergence Panida 33 EC @ 2.0 lha^{-1}, v) post-emergence Panida 33 EC @ 2.0 lha^{-1}, vi) pre-emergence Panida 33 EC @ 1.0 lha^{-1}, vii) post-emergence Panida 33 EC @ 1.0 lha^{-1}, viii) pre-emergence Neon 70 WG 1000 g ha^{-1}, ix) post-emergence Neon 70 WG 1000 g ha^{-1}, x) pre-emergence Neon 70 WG 750 g ha^{-1}, xi) post-emergence Neon 70 WG 750 g ha^{-1}, xii) pre-emergence Neon 70 WG 500 g ha^{-1}, xiii) post-emergence Neon 70 WG 500 g ha^{-1} and xiv) weed free. The unit plot size was 3m x 4m. The potato variety diamant was used as the test crop. The experiment was conducted in RCB design with three replications. The crop was planted on December 4, 2005 and November 26, 2006 with the spacing of 60 cm x 15 cm. The crop was fertilized with 150-43-140-22-2-1 kg N-P-K-S-Zn-B ha^{-1}. The crop was harvested on February 28, 2006 and February 20, 2007, respectively in two consecutive years. Data on weed population and their biomass were taken at 35 days of planting. The data were analyzed and mean separation were done by DMRT following Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The weed species, their population density and the efficiency of herbicides to control different weeds at 35 DAP are presented in Table 1. There were Bathua (*Chenopodium album*), Panigas (*Lindernia anagallis*), Mutha (*Cyperus rotundus*), Chapra (*Eleusine indica*), Durba (*Cynodon dactylon*). Bonocopy (*Gnaphalium affine*), Amrul (*Oxalis europea*) and Carpet agacha (*Glinus lotoides*) were the common weeds species. Among the weed species, *Chenopodum album*, *Cyperus rotundus*, *Eleusine indica* and *Gnaphalium affine* were the dominant weeds. The results indicated that post planting post emergence spraying of two herbicides showed better performance than post planting pre emergence spraying in controlling weeds (Table 2). Post planting post emergence spraying of Panida 33 EC and Neon 70 WP controlled all broad leaf weeds particularly *Chenopodium album*, *Lindernia anagallis*. *Gnaphalium affine*, *Oxalis europea* and *Glinus lotoides*. Among the different rates of herbicides Panida 33 EC @ 1.0 upto 3.0 l ha^{-1} and Neon 70 WG @ 750 upto 1000 g ha^{-1} showed similar results in controlling broad leaf weeds irrespective of their higher doses. The efficiency of Panida 33 EC @ 1.0 l ha^{-1} and Neon 70 WG @ 750 g ha^{-1} were also 100% effective in controlling broad leaf weeds. The result was in accordance with the findings of Pandey *et al.* (2001) who found excellent control of *Chenopodium album* and *Cornopus didymus* (94%) and effective to control of other weeed species by metribuzin. Divis (2002) in a field experiment during 1995-96 in Czech Republic found significant influence of pre-emergence herbicide on weed reduction. Yield in pre-emergence herbicide were 10% higher than the herbicide free plot. Ashok *et al.* (1999) found 86 to 98% weed control in an experiment in 1995-97 with metribuzin along with linuron and thus yield of potato increased significantly and the controlled weeds were *Chenopodium album, Lathyrus aphaca, Melilotus alba*

and *Coronopus didymus*. Bailey *et al.* (2001) conducted an experiment in USA in 1995 and 1996 to observe the effect of metribuzin on the weed control of potato. The findings showed 81 to 95 percent control of weed by the application of metribuzin. The reduction of total weed biomass of different weeds were also prominent by herbicides at 35 DAP (Table 3). Post emergence application of herbicide produced lower weed biomass than pre-emergence application in both the years. Among the post emergence treatments, Neon 70 WG @ 1000 g ha^{-1}, 750 g ha^{-1}, Panida 33 EC @ 3 l ha^{-1}, 2 l ha^{-1} and 1 l ha^{-1} were similar in producing weed biomass/m^2 with lowest value in Neon 70 WG @ 1000 g ha^{-1} (5.6 & 7.32, respectively in 1st and 2nd year). The highest weed biomass was in control (29.64 & 26.56 g/m^2) Boydston and Vaughn (2002) found lower weed density and weed biomass and higher yield with metribuzin @ 0.40 kg ha^{-1} in 1994 and 1995 in central Washington. Conley *et al.* (2001) reported lower weed biomass (12 g/m^2) in application of metribuzin with metachlor after conducting an experiment in Wisconsin, USA in 1996 and 1997 with the variety Russet, Bank, Russet Norkotah, Goldrush, DarkRed, Norland, Snowden and Atlantic. Yield of potato tubers in the year 2005-06 were significantly increased up to 51 and 49% over control by spraying Panida 33 EC @ 3.0 l ha^{-1} and Neon 70 WG @ 1000 g ha^{-1}, respectively at 9 DAP. Similar trend was also observed in 2006-07 where the yield increase by Panida 33 EC @ 3.0 l ha^{-1} and Neon 70 WG @ 1000 g ha^{-1} at 9 DAP were 48 and 54%. Lower the weed biomass higher was the yield. In the year 2005-06, the highest tuber yield (21.24 t ha^{-1}) was recorded from weed free plot which was statistically similar with post emergence Panida 33 EC @ 3 l ha^{-1} (20.81t ha^{-1}), post emergence Neon 70 WG @ 750 g ha^{-1} (20.16 t ha^{-1}), pre-emergence neon 70 WG @ 1000 g ha^{-1} (19.77 t ha^{-1}), pre-emergence Panida 33 EC @ 3 l ha^{-1} (19.32 t ha^{-1}), pre-emergence Panida 33 EC @ 2 l ha^{-1} (19.60 t ha^{-1}) and post-emergence Panida 33 EC @ 1 l ha^{-1} (19.00 t ha^{-1}) but significantly higher than the other treatments. Next year, 2006-07, similar trend was also observed where the highest tuber yield (23.80 t ha^{-1}) was followed by post emergence Neon 70 WG @ 1000 g/ha (23.20 t/ha), post emergence Neon 70 WG @ 750 g/ha (23.00 t ha^{-1}), post emergence Neon 1000 g ha^{-1}, post emergence Panida 33 EC @ 3 l ha^{-1} (22.32 t ha^{-1}), pre-emergence Panida 33 EC @ 2 l ha^{-1} (21.80 t ha^{-1}), pre-emergence Panida 33 EC @ 3 l ha^{-1} (21.74 t ha^{-1}), and post-emergence Panida 33 EC @ 1 l ha^{-1} (21.60 t ha^{-1}). Pandey *et al.* (2001) reported that metribuzin and pendimethalin caused an identical increase in tuber yield which was significantly higher than the increase in the other treatments. Singh *et al.* (2000) stated that pendimethalin @ 0.75 kg ha^{-1} moderately controlled the weeds in potato field and gave considerable increase in yield. In a field experiment conducted in summer season (March-July) in 1995 and 1996 at Meghalaya, India Singh (2000) reported metribuzin as highest weed controller (68%), highest yielder (17.2 t ha^{-1}) and highest yield increaser (122%) over control.

From the above findings it might be concluded that post planting post emergence (9 DAP) spraying of Panida 33 EC @ 1.0 l ha^{-1} and Neon 70 WG @ 750 g ha^{-1} in potato were most effective in controlling broad leaf weeds like *Chenopodium album*, *Lindernia anagalis*, *Gnaphalum affine*, *Oxalis europea* and *Glinus lotoides*.

Table 1. Effect on Neon 70 WG and Panida 33 EC on weed population in potato fields at Rangpur in 2005-06 (1st year) and 2006-07 (2nd year)

Treatments	Weed species m^{-2} (no)															
	Chenopodium album		*Lindernia anagallis*		*Cyperus Rotundus*		*Eleusine indica*		*Cynodon dactylon*		*Gnaphalium affine*		*Oxalis europea*		*Glinus lotoides*	
	1st Yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.
Control	56a	62a	24a	30	48a	51a	36a	41a	28cd	30cd	44a	40a	16a	20a	8a	11a
Pre-Panida 3 l ha^{-1}	0c	0c	0b	0b	36bc	30cd	12d	15d	44ab	40abc	0c	0c	0c	0c	0b	0b
Post-Panida 3 l ha^{-1}	0c	0c	0b	0b	20d	18ef	6e	8e	32cd	36abc	0c	0c	0c	0c	0b	0b
Pre-Panida 2 l ha^{-1}	0c	0c	0b	0b	42ab	38b	14cd	18cd	48a	47a	0c	0c	0c	0c	0b	0b
Post-Panida 2 l ha^{-1}	0c	0c	0b	0b	24d	20ef	8e	9e	36bc	38abc	0c	0c	0c	0c	0b	0b
Pre-Panida 1 l ha^{-1}	0c	0c	0b	0b	44a	46a	16d	16d	42ab	40abc	0c	0c	0c	0c	0b	0b
Post-Panida 1 l ha^{-1}	0c	0c	0b	0b	32c	35bc	16cd	19cd	48a	45a	0c	0c	0c	0c	0b	0b
Pre-Neon 1000 g ha^{-1}	0c	0c	0b	0b	18de	22ef	12bc	13bc	32cd	35abc	0c	0c	0c	0c	0b	0b
Post-Neon 1000 g ha^{-1}	0c	0c	0b	0b	12e	10g	6e	7e	31cd	32bcd	0c	0c	0c	0c	0b	0b
Pre-Neon 750 g ha^{-1}	0c	0c	0b	0b	24d	25de	29b	25b	24d	21d	0c	0c	0c	0c	0b	0b
Post-Neon 750 g ha^{-1}	0c	0c	0b	0b	19de	16fg	8e	7e	32cd	29cd	0c	0c	0c	0c	0b	0b
Pre-Neon 500 g ha^{-1}	4b	5b	0b	0b	34c	36bc	32a	40a	46a	44ab	6b	7b	4b	6b	0b	0b
Post-Neon 500 g ha^{-1}	0c	0c	0b	0b	22d	25de	24b	26b	36bc	39abc	0c	0c	0c	0c	0b	0b
LSD	1.23	1.40	1.10	1.09	6.89	7.29	6.71	5.43	7.95	10.77	1.39	1.36	0.63	0.63	0.31	0.31
Sx	0.31	0.35	0.28	0.27	1.74	1.84	1.50	1.37	2.01	2.72	0.35	0.34	0.16	0.16	0.79	0.07
CV (%)	11.64	11.83	26.02	13.01	10.45	11.15	14.64	12.18	9.44	12.92	15.85	16.57	22.53	18.03	22.53	16.39

Table 2. Effect on Neon 70 WG and Panida 33 EC on percent weed reduction over control in potato fields at Rangpur in 2005-06 (1st year) and 2006-07 (2nd year)

Treatments	Weed number reduction m^{-2} (%)															
	Chenopodium album		*Lindernia anagallis*		*Cyperus rotundus*		*Eleusine indica*		*Cynodon dactylon*		*Gnaphalium affine*		*Oxalis europea*		*Glinus lotoides*	
	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.	1st yr.	2nd yr.
Control	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-Panida 3 l ha^{-1}	100	100	100	100	25	41	67	63	-57	-33	100	100	100	100	100	100
Post-Panida 3 l ha^{-1}	100	100	100	100	58	65	83	80	-14	-20	100	100	100	100	100	100
Pre-Panida 2 l ha^{-1}	100	100	100	100	13	25	61	56	-71	-57	100	100	100	100	100	100
Post-Panida 2 l ha^{-1}	100	100	100	100	50	61	78	78	-29	-27	100	100	100	100	100	100
Pre-Panida 1 l ha^{-1}	100	100	100	100	8	10	56	61	-50	-33	100	100	100	100	100	100
Post-Panida 1 l ha^{-1}	100	100	100	100	33	31	56	54	-71	-50	100	100	100	100	100	100
Pre-Neon 1000 g ha^{-1}	100	100	100	100	63	41	67	68	-14	-17	100	100	100	100	100	100
Post-Neon 1000 g ha^{-1}	100	100	100	100	75	80	83	83	-11	-7	100	100	100	100	100	100
Pre-Neon 750 g ha^{-1}	100	100	100	100	50	51	19	39	14	30	100	100	100	100	100	100
Post-Neon 750 g ha^{-1}	100	100	100	100	60	69	78	83	-14	3	100	100	100	100	100	100
Pre-Neon 500 g ha^{-1}	93	92	100	100	29	29	11.11	2	-64	-47	86	83	75	70	100	100
Post-Neon 500 g ha^{-1}	100	100	100	100	54	51	33	37	-29	-30	100	100	100	100	100	100

Table 3. Effect of Neon 70 WG and Panida 33 EC on Weed biomass and yield of potato in 2005-06 (1st year) and 2006-07 (2nd year)

Treatments	Weed biomass at 35 DAP (g m^{-2})			Potato Tuber yield (t ha^{-1})			Relative yield (% over control)		
	1st yr.	2nd yr.	Mean	1st yr.	2nd yr.	Mean	1st yr.	2nd yr.	Mean
Control	29.64 a	26.56 a	28.1	13.80 d	15.10 d	14.5	100	100	100
Pre-Panida 3 l ha^{-1}	17.24 bc	16.08 cd	16.66	19.32 ab	21.74 a	20.53	140	144	142
Post-Panida 3 l ha^{-1}	11.04 fg	9.80 gh	10.42	20.81 a	22.32 a	21.565	151	148	149
Pre-Panida 2 l ha^{-1}	18.21 b	18.10 c	18.155	15.96 cd	17.5 bc	16.73	116	116	116
Post-Panida 2 l ha^{-1}	12.6 ef	11.75 fg	12.175	19.60 ab	21.80 a	20.7	142	144	143
Pre-Panida 1 l ha^{-1}	19.4 b	21.65 b	20.525	14.52 d	16.25 cd	15.38	105	108	106
Post-Panida 1 l ha^{-1}	12.32 f	12.20 f	12.26	19.00 ab	21.60 a	20.3	138	143	140
Pre-Neon 1000 g ha^{-1}	9.4 gh	9.82 gh	9.61	19.77 ab	22.60 a	21.18	143	150	146
Post-Neon 1000 g ha^{-1}	5.6 i	7.32 i	6.46	20.54 ab	23.20 a	21.87	149	154	151
Pre-Neon 750 g ha^{-1}	14.6 de	15.50 de	15.05	18.10 bc	18.15 bc	18.12	131	120	125
Post-Neon 750 g ha^{-1}	7.36 hi	8.48 hi	7.92	20.16 ab	23.00 a	21.58	146	152	149
Pre-Neon 500 g ha^{-1}	15.68 cd	17.16 cd	16.42	14.18 d	17.50 bc	15.84	103	116	109
Post-Neon 500 g ha^{-1}	12.96 ef	13.64 ef	13.3	15.21 d	18.60 b	16.91	110	123	117
Weed free				21.24 a	23.80 a	22.52	154	158	155
LSD	2.08	2.013		2.22	2.09				
S_x	0.715	0.68		0.7623	0.718				
CV (%)	8.66	8.26		7.33	6.16				

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