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Effect of common salt and 2, 4-D Na salt application on weed growth and yield of upland direct seeded rice

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ABSTRACT

The effect of time of application (10 and 30 Days after sowing) and doses of common salt viz.,50, 100 and150 kg ha $^{-1}$ and 2,4-D Na salt @1.5 kg ha^{-1} application on weed growth and yield of direct seeded upland rice was evaluated during wet seasons of 2003 and 2004. Application of 2, 4-D @1.5 kg ha^{-1} applied at 10 and 30 days after sowing significantly reduced weed population and dry matter accumulation, and was at par with common salt @150 kg ha^{-1} applied at 10 and 30 DAS. 2,4-D Na salt @1.5 kg ha^{-1} applied at 10 and 30 DAS recorded better growth ,yield attributes and yield viz., plant height ,number of tillers hill^{-1}, dry matter accumulation, number of panicles m^{-2} number of effective grains panicle^{-1} and grain yield in comparison to common salt @50 kg ha^{-1} applied at 10 and 30 DAS. The highest benefit cost ratio was recorded with 2, 4-D Na salt @1.5 kg ha^{-1} applied at 10 days after sowing (2.47) followed by common salt @150 kg ha^{-1} applied at 10 days after sowing. Early application of common salt and 2, 4-D (10days after sowing) recorded more grain yield and benefit cost ratio in comparison of latter application(30DAS) of these treatments. Common salt application was not economical in comparison to 2, 4-D application.

Key words: *Direct seeded rice, 2, 4-D Na salt, common salt, weed management*

Rice is primarily raised under *jhum*, terrace and valley lands during wet season in north east hill region of India. In the *jhum* land , rice seeds are directly sown whereas in terrace and valley lands rice seedlings are transplanted. Early emergence of weeds along with crop seedlings and their rapid growth rate due to intermittent rains in *jhum* lands results in heavy weed infestation. The weed infestation is more severe in upland conditions (71%) as compared to wetland (29%) conditions (Hazarika *et al*, 2001). Weeds cause heavy damage to direct seeded rice crop which can be to the tune of 5-100% (Kolhe, 1989). *Jhum* farmers of the region traditionally apply common salt in upland rice crop as post emergence spray to control annual broad leaf weeds. Common salt is not a recommended herbicide to control broad leaved weeds, however, alien weeds like *Ageratum conyzoides* and *Parthenium hysterophorus* have been successfully controlled by 15-20% common salt applicaton (Singh *et al*, 1996). 2, 4-D Na salt is widely used for post emergence broad leaved weed and sedge control (Moody, 1994).Since farmer's are applying common salt in *jhum* fields it is, therefore, essential to investigate precise dose, timing of common salt application and vis-à-vis 2, 4-D Na salt application in upland rice under hill conditions of North East region of India. Therefore, the present experiment was undertaken to ascertain the effect of timing and doses of common salt and 2, 4-D application on weed growth and yield in upland rice under foothill conditions of Nagaland.

MATERIALS AND METHODS

A field experiment was conducted at Agricultural Research Farm, School of Agricultural Sciences and Rural Development, Nagaland University, Medizphema, Nagaland during wet season of 2003 and 2004 with treatment consisting of three doses of common salt (50,100 and 150 kg ha^{-1}) and 2,4-D Na salt @ 1.5 kg

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ha^{-1}applied at 10 and 30 DAS and control (weedy) in Randomized Complete Block Design with three replications(Table 1). The experimental site was situated at an elevation of 309m above mean sea level between 25 45¢ 43² N latitude and 93° 53¢ 04² E longitude. The climate of the experimental site was subtropical in nature exhibiting high humidity and medium to high rainfall. The soil was sandy loam, extremely acidic in reaction (pH = 4.7), medium in available nitrogen (282 kg ha^{-1}), low in phosphorous (10.3 kg ha^{-1}) and low in potassium (107 kg ha^{-1}). The local rice cultivar *Leikhumo* (130-140 days duration) was sown in the second week of April during both the years. The crop was dibbled seeded at 70 kg ha^{-1}at a spacing of 25cm x 10cm. A uniform dose of 90 Kg N, 40 Kg P_2O_5 and 40 Kg K_2O per hectare were applied uniformly through urea, single super phosphate and muriate of potash, respectively. Nitrogen was applied in three splits i.e. 50% as basal and remaining in two equal splits at tillering and panicle initiation. Herbicides and common salt were applied through flat fan nozzle using water as carrier @ 500 l ha^{-1}.All the improved package of practices were followed to raise the crop under rainfed condition. Weed samples for recording weed population (m^{-2}) and dry matter (g.m^{-2}) were collected from three places in each plot using 0.25 m^2 quadrate at 60 days stage and at harvest. An amount of 1445 mm and 1599 mm (April- Sept.) of rainfall was received during wet season in 2003 and 2004, respectively. The net return (Rs. ha^{-1}) and benefit cost ratio was calculated by considering the sale prices of rice and cost of cultivation.

RESULTS AND DISCUSSION

The weeds of the experimental plot were diverse in nature. The major weed of the experimental field were *Ageratum conyzoides* (8%), *Amaranthus viridis* (5%), *Boreria hispida* (30%), *Chromolaena odorata* (2%), *Digitaria sanguinalis* (25%), *Elusine indica* (4%), *Euphorbia hirta* (4%), *Mikania micrantha* (2%), *Mimosa pudica* (3%) and *Setaria glauca* (2%). The number of weed species belonging to broad leaf species (58%) was more in comparison to narrow leaf weed species (38%).

All the weed control treatment reduced the weed population and dry matter accumulation of weed in comparison to weedy check at both stages of

Table 1. Effect of tme and doses of common salt and 2,4-D Na salt application on weed and crop growth of upland direct seeded rice (average data of two years).

Treatment	Dose (kg ha^{-1})	Application stage (DAS)	Weed population m^{-2}		Weed dry matter (g.m^{-2})		Plant height (cm)		Number of tillers. hill^{-1} at 60 DAS	Dry matter accumulation (g.plant^{-1})	
			60 DAS	At harvest	60 DAS	At harvest	60 DAS	At harvest		60 DAS	At harvest
Common Salt	50	10	128.5	161.8	248.3	440.6	65.6	104.3	4.9	50.8	69.1
Common Salt	100	10	113.3	141.1	224.8	376.3	69.0	105	5.0	53.9	70.8
Common Salt	150	10	94.5	128.3	207.6	360.6	72.0	106	5.5	55.0	75.9
2,4-D	1.5	10	85.6	110.0	177.8	292	74.1	117	6.3	61.2	76.2
Common Salt	50	30	120.5	157.0	229.0	391.6	69.9	104.3	4.5	52.2	68.1
Common Salt	100	30	115.5	148.8	210.5	364.6	71.9	102.3	4.6	53.5	71.3
Common Salt	150	30	100.3	146.1	189.5	330.6	72.4	108.1	5.0	53.2	74.2
2,4-D	1.5	30	85.8	130.3	159.0	253.3	76.1	120	5.7	61.3	76.8
Weedy	-	-	139	187.0	383	580.0	56.2	92.3	3.2	39.7	47.6
CD (P=0.05)	-	-	17.18	21.65	19.72	68.0	5.70	8.56	0.92	6.46	7.99

DAS-days after sowing

observation (Table 1). At 60 days and at harvest, application of 2, 4-D Na salt @1.5 kg ha^{-1} applied at 10 DAS significantly reduced weed population and dry matter accumulation in comparison to common salt @ 50 and 100 kg ha^{-1} applied at 10 and 30 DAS. However, 2, 4-D Na salt @1.5 kg ha^{-1} at either stage had statistically equivalent weed population and dry matter accumulation. Variations in weed population and dry matter accumulation due to application of common salt @150 kg ha^{-1} at both the stages were at par with 2, 4-D Na salt @ 1.5 kg ha^{-1} applied at both the stages. Common salt application affect the osmotic process directly damaging the leaves of weeds and consequently killing the weeds, however, phytotoxic effect of common salt was not observed on rice crop. Reduction in weed population and dry matter accumulation was achieved by better control of annual broad leaf weeds due to application of 2, 4-D Na salt. Effective control of non grasses and sedges due to post emergence application of 2, 4-D have been also reported by Singh (2005).

Full season weed infestation significantly reduced, plant height, number of tillers $hill^{-1}$ and dry matter accumulation of crop in comparison to levels and time of common salt and 2, 4-D Na salt application (Table 1). At 60 days and at harvest stage, the tallest plant was recorded with 2, 4-D Na salt applied at 30 DAS and it was at par with 2, 4-D Na salt applied at 10 DAS. However, at 60 days stage, 2, 4-D Na salt @ 1.5 kg ha^{-1} applied at 30 DAS was statistically equivalent to common salt @ 150 kg ha^{-1} applied at 10 DAS and common salt @ 100 and 150 kg ha^{-1} applied at 30 DAS. The maximum number of tillers $hill^{-1}$ was recorded with 2, 4-D Na salt@ 1.5 kg ha^{-1} applied at 10 DAS and it was at par with 2, 4-D Na salt @ 1.5 kg ha^{-1} applied at 30 DAS and common salt @ 150 kg ha^{-1} applied at 10 DAS. At 60 days, application of 2, 4-D Na salt @1.5 kg/ha applied at 10 and 30 DAS and common salt @ 150 kg ha^{-1} applied at 10 DAS had statistically comparable dry matter accumulation. At 60 days, common salt @ 50 and 100 kg ha^{-1} applied at 10 and 30 DAS had significantly lesser dry matter accumulation in comparison to 2,4-D Na salt @ 1.5 kg ha^{-1} at both stages of application, all the former treatment were at par with each other. At harvest stage, variation in dry matter accumulation due to all the herbicidal treatment were at par with each other except weedy check and common salt @ 50 kg ha^{-1} applied at 30 DAS which were significantly inferior to the rest of the herbicidal treatment. These findings were due to better crop growth and reduction in crop weed competition in weed control treatments viz.,2, 4-D Na salt @1.5 kg ha^{-1} applied at 10 and 30 DAS and common salt application @ 150 kg ha^{-1}.

Weedy check significantly reduced number of panicles m^{-2} and grain yield in comparison to herbicidal treatments. Weedy check had also significantly lesser number of fertile grains $panicle^{-1}$ in comparison to all the herbicidal treatments except common salt @ 50 kg ha^{-1} applied @ 10 DAS (Table 2). Application of 2, 4-D Na salt @1.5 kg ha^{-1} applied at 10 and 30 DAS had statistically comparable number of panicles m^{-2}. However, the former treatment had significantly more number of panicles m^{-2} in comparison to common salt @ 50, 100 and 150 kg ha^{-1} applied at 10 and 30 DAS. Among the herbicidal treatment, 2,4-D Na salt @ 1.5 kg ha^{-1} applied at 10 and 30 DAS and common salt @ 150 kg ha^{-1} applied at 30 DAS had comparable number of effective grains $panicle^{-1}$. The better performance of yield attributes in weed control treatment might be due to enhanced crop growth attributes and effectiveness of chemicals in controlling the weeds. (Table 1).

Application of common salt @150 kg ha^{-1} applied at 10 and 30 DAS had statistically comparable grain yield in comparison to 2,4-D Na salt @ 1.5 kg ha^{-1} applied at 10 and 30 DAS. However, 2, 4-D Na salt 1.5 kg ha^{-1} applied at 10 DAS recorded the maximum grain yield and had better net return and benefit cost ratio in comparison to various levels and stages of common salt application. The per cent increase in grain yield over weedy due to common salt application @ 50,100,150 kg ha^{-1} applied at 10 and 30 DAS were 63.6 and 60.4,66.3 and 63 ,73.5, 70.3 , respectively, whereas, 2,4-D Na salt @1.5 kg ha^{-1} applied at 10 and 30 DAS had 75.8 and 73.8 per cent reduction in grain yield. Early application (10 DAS) of 2,4-D Na salt and common salt resulted in better control of weeds and recorded more grain yield than latter application (30DAS).Common salt@ 150 kg ha^{-1} and post emergence 2, 4-D application recorded more yield in comparison to weedy, due to higher number of panicles m^{-2} and number of fertile grains $panicle^{-1}$.Significantly higher yield in comparison to weedy has been also reported by Vaishya and Tomar (2000) in case of post emergence 2,4-D application.

Table 2. Effect of time and doses of common salt and 2, 4-D Na salt application on yield attributes, yield and economics of upland direct seeded rice.(average data of two years).

Treatment	Dose ($kg.ha^{-1}$)	Application stage(DAS)	Number of panicle.m^{-2}	Number of fertile grains panicle $^{-1}$	1000 grain weight (g)	Grain yield ($t\ ha^{-1}$)	Net return ($Rs.ha^{-1}$)	B:C Ratio
Common salt	50	10	122.6	127.3	21.16	1.76	4300	1.55
Common salt	100	10	132.5	140.3	21.42	1.90	4917	1.74
Common salt	150	10	141.6	145.0	22.09	2.42	8146	2.30
2,4-D	1.5	10	166.6	157.6	21.89	2.65	9549	2.47
Common salt	50	30	120.0	139.8	21.46	1.62	5140	1.52
Common salt	100	30	127.3	140.3	21.64	1.73	4557	1.69
Common salt	150	30	140.6	150.1	22.15	2.16	6300	1.93
2,4-D	1.5	30	153.3	157.1	21.90	2.45	8372	2.29
Weedy	-	-	97.1	123	19.70	0.64	-1955	0.67
CD (P=0.05)	-	-	19.8	12.42	NS	0.63		

DAS-days after sowing

The experimental findings proved that common salt @150 kg ha^{-1} may be applied to control annual broad leaved weeds in upland direct seeded rice under hill conditions of north east region of India. However, common salt application was not economical in comparison to 2, 4-D Na salt @ 1.5 kg ha^{-1} applied at 10 days after sowing.

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