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Studies on efficiency of different botanical herbicides on weed management of rice (cv. Gobindobhog)

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Abstract
The aromatic rice variety Gobindobhog was used in the experiment which was carried out in RBD design with 8 treatments and 3 replications. The treatments were: T_1 = Control plot, T_2 =Two hand weeding @ 20 and 40 DAT; T_3 =Mechanical weeding @ 20 and 40 DAT; T_4 =*Cyperus rotundus* extract + 1 mechanical weeding at 30 DAT; T_5=*Echinochloa colona* extract +1 mechanical weeding at 30 DAT ; T_6 =*Bambusa vulgaris* leaf & shoot extract + 1 mechanical weeding at 30 DAT; T_7=*Cucumis sativus* leaf extract + 1 mechanical weeding at 30 DAT, and T_8=*Xanthium strumanium* leaf extract + 1 mechanical weeding at 30 DAT. The result revealed that the application of botanical herbicides had a significant influence on weed control efficiency, weed control index, growth and yield of crop which was found highest under the treatment T_7 followed by T_6. T_7 treatment had maximum number of effective tiller that produced highest yield (3717 kg/ha). Thus, it may be concluded that application of Cucumber leaf extract along with one mechanical weeding at 30 DAT gives highest weed control efficiency.

Keywords: Botanical herbicides, weed control efficiency, weed control index, grain yield

Introduction
Rice is India's pre-eminent crop, and is the staple food of the people of the eastern and southern parts of the country. Around 65 percent of the total population of India eats rice and it accounts for 40 percent of their food production. Rice based production systems provide the main source of income and employment for more than 50 million households. Production of rice, the most popular staple, is estimated to increase by over 2 million tonnes, from 104.4 million tonnes last year to 106.7 million tonnes in 2016-17 (Union Agricultural ministry of India, Feb 15 2017). The problem of weed competition with rice is of great economic importance in the country because it causes a 10–35% reduction in grain yield. Weeds show competition with crops for nutrient, light, space and moisture [1]. In upland direct seeded rice, yield may be reduced by 30-75 % if weeds are not controlled, similarly in transplanted rice, yield may be reduced by 15-35 % due to weeds [2]. The critical period of crop-weed competition in upland rice is 10-45 DAS & in transplanted rice is 30-45 DAT [3]. In an experiment it was found that competition of one kind of weed namely *Echinochloa crusgali* in paddy fields reduced rice yield around 25% [4]. Herbicides are synthetic chemicals used to kill or suppress unwanted vegetation. It is found that synthetic herbicides, have been detected in ground water in some areas of the country. Excessive application of pesticides including could cause the pesticide to run off or seepage into water supplies and contaminate them [5]. Some formulations of 2,4-D can be highly toxic to fish [6]. Heavy treatment of soil with pesticides including herbicides can cause populations of beneficial soil microorganisms to decline [7]. Continuous use of herbicides particularly narrow-spectrum ones may cause weed flora shift [8]. Continuous use of the same herbicides or group of herbicides having similar mode of action may cause insurgence of herbicide resistant weeds [9, 10]. Synthetic herbicides are cost consuming also. Several allelochemicals of some plants have the potential for use as herbicides and have provided structural models for herbicide development [11]. It was also reported that the common allelochemicals, *viz.* salicylic acid, p-hydroxy benzoic acid, hydroquinone and umbelliferone effectively suppressed the growth of several weeds when applied as spray [12]. Plant extracts (compound mixtures) potentially possess multiple phytotoxic compounds and hence multiple modes of simultaneous herbicidal attack, making it more difficult for weeds to develop herbicide resistance and most products show wide windows of crop safety [13]. There are so many plants having potentiality to act as botanical herbicides. These are janglidhan (*Echinochloa colona*), wild radish (*Blumea lacera*), Mutha gash (*Cyperus rotundus*), segun (*Tectona grandis*), Bamboo (*Bambusa vulgaris*), akanda (*Calotropis procera*), wild caroot *(Parthenium histerophorus*), juiphool (*Jasmium officinals*), takbhindi (*Hibiscus sabdariffa*),

cocklebour (*Xanthium strumarium*).In an one experiment it was shown that *Ocimum sanctum* extacts 5% (w/v) gave highest grassy weed population control while *Ageratum conyzoides* extract 5%(w/v) gaves highest broad leaf weed population control [14]. Again an another experiment it was shown that higher growth and yield of seasame and green gram under *Ageratum conyzoides* extract but higher harvest index and soil nutrient status under *Ocimum sanctum* extracts [15].

Materials and Methods

The experimental was conducted at Kalyani In-check farm ($22^0$57" N latitude and $88^0$2" longitude) in 2016 to find out the efficiency of botanical herbicides along with mechanical weed management into the rice field (cv. Gobindabhog). The soil of the experimental farm was sandy loam in texture and the average annual rainfall was 1460 mm which mostly precipitated during June to September months. In this experiment eight treatments were used in RBD with 3 replication and the plots size was 5m × 3m (table.1). The botanical extracts of *Cyperus rotundus*, *Echinichloa colona* leaf, *Bambusa vulgaris* leaf and shoot, *Cucumis sativus* leaf, *Xanthium strumanium* leaf along with mechanical weeding at 30 DAT used in rice field to check weed infestation. Weed control efficiency (WCE) and weed control index (WCI) parameter were recorded in case of weed infestation and incase of rice observations were recorded on leaf area index (LAI), crop Growth rate (CGR), and various yield attributes, yield and economics of rice.

Table 1: Treatment details

Treatments	Details
T_1	Control
T_2	Two hand weeding @ 20 and 40 DAT
T_3	Mechanical weeding @ 20 and 40 DAT
T_4	*Cyperus rotundus* extract + 1 mechanical weeding at 30DAT
T_5	*Echinochloa colona* leaf extract + 1 mechanical weeding at 30DAT
T_6	*Bambusa vulgaris* leaf and shoot extract + 1 mechanical weeding at 30 DAT
T_7	*Cucumis sativus* leaf extract + 1 mechanical weeding at 30 DAT
T_8	*Xanthium strumanium* leaf extract + 1 mechanical weeding at 30 DAT

Results and Discussion

The dominant weed species in the field was *Cyperus rotundus, Echinochloa colona, Portulacaoleracea, alternanthera philoxeroides, Alternanthera sessilis, Cynodon dactylon, Fimbristylis miliacea, Cyperus difformis, Echinochloa crusgalli, Ludwigia parviflora*. The aqueous extract of botanicals (*Cyperusrotundus, Echinochloa colona* leaf, *Bambusa vulgaris* leaf and shoot, *Cucumis sativus* leaf, *Xanthium strumanium* leaf extract) at @ 100ml per 1 lit water as a pre-emergence application alone with mechanical weeding at 30 DAT. The weed control efficiency (WCE) in rice filed was significantly influenced by different botanical herbicides at different growth stages i.e., 15 30, 45 and 60 DAT. WEC was found higher under *Cucumis sativus* leaf extract + mechanical weeding at 30 DAT (T_7) at 15 DAT (42% WCE) and it also sustained upto 30 DAT (48%) and thereafter received mechanical weeding and their combined effect leading to sustained higher magnitude of WCE till 60 DAT.

Table 2: Effect of different botanical herbicides on WCE AT 15, 30, 45 AND 60DAT

Treatment	WCE at 15 DAT	WCE at 30 DAT	WCE at 45 DAT	WCE at 60 DAT
T_1	0	0	0	0
T_2	35	22	37	48.86
T_3	32	19	44	31.13
T_4	16	24	168	48.89
T_5	23	25	75	51.13
T_6	41	34	35	55.60
T_7	42	48	62	53.33
T_8	38	27	12	42

Incase of weed control index (WCI) in rice field it was significantly influenced by botanicals aqueous extract. WCI was found higher under mechanical weeding at 20 and 40 DAT (T_3), (53%) followed by *Cucumis sativus* leaf extract + mechanical weeding at 30 DAT (T_7) (40%). *Cucumis sativus* leaf extract + mechanical weeding at 30DAT (T_7) showed highest WCI at 45 DAT (76%) and 60 DAT (66.66%).

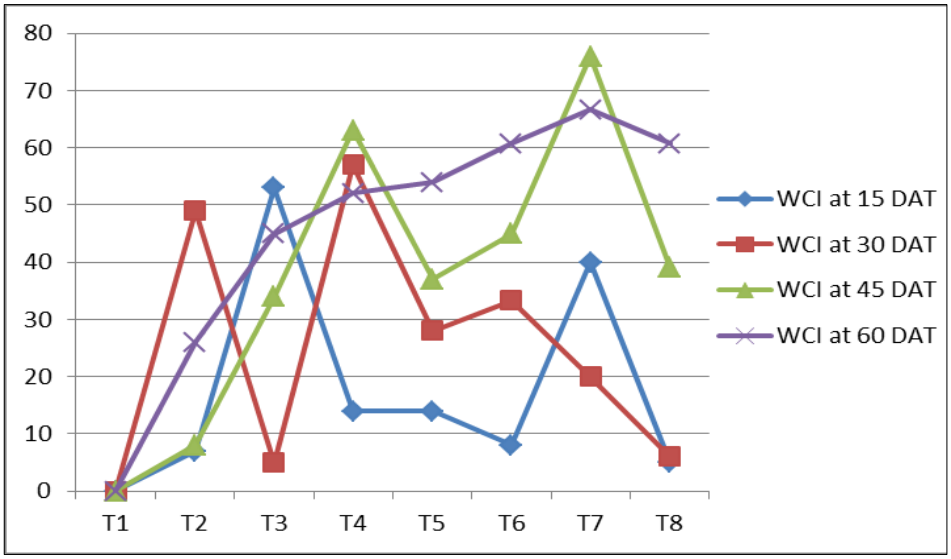

Fig 1: Effect of different botanical herbicides on WCI at 15, 30, 45 and 60DAT

Effect of different botanical herbicides did not show any significant effect on LAI of rice. However, progressive increment of LAI was observed over LAI value at 30DAT and reached their maximum LAI values at 75 DAT where higher LAI values was found in *Echinochloa colona* extract +1 mechanical weeding at 30 DAT (T_5). But incase of CGR of rice plant was significantly influenced by different botanical herbicides at different growth stages. Higher magnitude of CGR values was obtained between 60 and 75 DAT and thereafter CGR values started to decline. Between 60 DAT and 75 DAT, higher CGR value was obtained in two hand weeding @ 20 and 40 DAT (T_2).

Table 3: Effect of different botanical herbicides on crop growth rate at 15, 30, 45 and 60DAT

Treatment	CGR at 30-45 DAT (g/m^{-2} –day)	CGR at 45-60 DAT (g/m^{-2} –day)	CGR at 60-75 DAT (g/m^{-2} –day)	CGR at 75-90 DAT (g/m^{-2} –day)	CGR at 90 DAT (g/m^{-2} –day)
T_1	0.54	0.65	0.73	0.58	0.58
T_2	0.48	0.31	1.06	0.17	0.17
T_3	0.32	0.69	1.05	0.10	0.10
T_4	0.27	0.71	0.95	0.46	0.46
T_5	0.58	0.65	1.03	0.91	0.15
T_6	0.45	0.70	1.00	0.76	0.35
T_7	0.57	0.61	0.92	0.89	0.49
T_8	0.49	0.49	0.78	0.89	0.77

Effective tiller m^{-2}, no of filled grain per panicle, grain filling percentage and test weight of rice were significantly influenced by different botanical herbicides. Significantly higher no of effective tiller m^{-2} (290) and higher no of filled grain per panicle 132.00) of rice were obtained with the application of *Cucumis sativus* leaf extract coupled with one mechanical weeding at 30 DAT (T_7) followed by *Echinochloa colona* extract +1 mechanical weeding at 30 DAT (T_5), *Xanthium strumanium* leaf extract + 1 mechanical weeding at 30 DAT (T_8) over control plot (T_1) without any significant difference among them. Mechanical weeding at 20 and 40 DAT showed appreciable no of panicle of rice after T_7, T_5, T_8 and T_6 without any significant difference between them.

Like no of effective tiller m^{-2}, grain filling percentage also showed significantly influenced by different botanicals. Highest grain filling percentage was observed in T_7 (71.33%) followed by T_4 (70.33%), T_8 (69.33) and T_6 (68.67). Test weight of rice was not influenced by significantly by the different botanical herbicides. However, higher test weight found in T_6 followed by T_8 and T_7.

Table 4: Effect of different botanical herbicides on various yield attributes of rice.

Treatment	Effective tiller m^{-2}	No of filled grain/panicle	Panicle length	Grain filling percentage (%)	Test weight
T1	195.64	120.00	18.08	64.67	9.89
T2	206.65	122.0	21.19	66.67	10.56
T3	226.64	127.00	21.50	69.67	11.59
T4	193.31	126.00	20.59	70.33	11.74
T5	239.98	130.00	22.40	67.67	11.78
T6	224.31	126.00	21.68	68.67	12.41
T7	290.97	132.00	22.66	71.33	12.24
T8	237.64	125.00	20.67	69.33	12.26
SEm±	40.17	1.60	1.34	1.51	1.26
CD (5%)	121.32	4.88	4.08	4.59	N.S

Grain yield, straw yield and harvest index of rice were significantly influenced by different botanical herbicides. Significantly higher yield (3717 kg/ha) of rice was obtained with the application of *Cucumis sativus* leaf extract coupled

with one mechanical weeding at 30 DAT (T_7). Like grain yield Straw yield was also affected with different botanical herbicides where maximum under treatment mechanical weeding at 20 and 40 DAT (T_3). Harvest index values were found higher in all treatments with botanical herbicides application along with mechanical weeding at 30 DAT as compared to both hand weeding and mechanical weeding at 20 and 40 DAT.

Table 5: Effect of different botanical herbicides on grain yield, straw yield and harvest index of rice.

Treatment	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
T1	2430	3370	41.89
T2	3550	4440	43.73
T3	3467	4460	43.74
T4	3367	4170	44.67
T5	3617	4380	45.23
T6	3690	4420	45.49
T7	3717	4450	45.51
T8	3633	4340	45.56
SEm±	144	117	
CD (5%)	426	356	

Incase of benefit cost ratio of rice was found to be influenced by different botanical herbicides. Higher B:C ratio was calculated in all treatments with botanical herbicides except treatment *Cyperus rotundus* extract + 1 mechanical weeding at 30 DAT (T_4).

Table 6: Effect of different botanical herbicides on economics of rice.

Gross return	Cost of cultivation	B:C ratio
55340	31250	1.77
77800	40740	1.90
78260	40260	1.94
75680	39650	1.90
81100	40020	2.03
82640	40640	2.05
83240	40450	2.06

Conclusion

The results revealed that application of different botanical herbicides had a significant influence on weed population, weed dry weight, weed control efficiency, weed control index and growth and yield of rice crop. Significantly Lower weed population of *Cyprerus rotundus* and *Cynodon dactylon* was observed in T7 (1.67 /sq.m and 2.33/ s.q.m.) at 15 DAT. WCE was found higher due to application of different botanical herbicides at 15 DAT where highest WCE value was found in T7 (42%) followed by T6 (41 %) and T8 (38%). Significantly higher number of panicle/sq.m. (290.97) of rice was obtained in T7 followed by T5, T8 over untreated control (T1) without any significant difference among them. Both hand weeding (3450 kg/ha) and mechanical weeding (3467 Kg/ha) at 20 and 40 DAT showed appreciable quantum of grain yield of rice after T7, T6, T8 and T5 without any significant difference between them. Among the botanical herbicides, T7 showed highest B:C ratio (2.06) followed by T6,T8 andT5. Thus, it may be concluded that application of either *Cucumis sativus* leaf extract or *Bambusa vulgaris* leaf and shoot extract or *Echinochloa colona* plant extract or *Xanthium strumanium* leaf extract along with one mechanical weeding at 30 DAT can be used as an effective weed control measures in transplanted paddy field.

References

1. Singh UP, Singh RK, Singh RP. Performance of herbicides and cultivars under zero till situation of rainfed lowland rice eco-system. Indian J Weed Sci. 2004; 36(1-2):122-123.
2. Rao AN, Johnson DE, Sivaprasad B, Ladha JK, Mortimer AM. Weed management in direct-seeded rice. Advances Agron. 2007; 93:155-255.
3. Rahaman MT, Ahmed S, Lipi NJ, Rashid MH, Hoque MI. Critical period of weed competition in transplanted aus rice cv. BRRI dhan27 under non-saline agro-ecosystem. Bangladesh Agron. J. 2014; 17(1):95-102.
4. Islam MZ, Haq KA, Bhuiyan LR. Effect of different water management practices on grain yield, weed population and recovery of applied nitrogen in rice cultivation. Bangladesh J Agric. Research. 1986; 11(3):57-64.
5. Szekacs A, Mortal M, Darvas B. Monitoring pesticide residues in surface and ground water in Hungary: survey in 1990-2015. J chemistry. 2015; 20(15):15.
6. Meehan WR, Norris LA, Sears HS. Toxicity of various formulations of 2,4-D to salmonids in Southeast Alaska. J Fish. Research Board of Canada, 1974, 31(4).
7. Kelley WD, South DB. *In vitro* effects of selected herbicides on growth and mycorrhizal fungi. Weed Sci. Soc, 1978, 38.
8. Mishra JS, Rao AN, Singh VP, Kumar R. Weed management in major field crops. Indian Society of Agronomy, 2016, 1-21.
9. Urech PA, Staub TVG. Resistance as a concomitant of modern crop protection. Pesticide sci. 1997; 51(3):227-234.
10. Alebrahim MT, Zangoueinejad R, Tseng TM. Biochemical and molecular knowledge about developing herbicide-resistant weeds. Herbicide resistance in weeds and crops, 2017.
11. Khanh TD, Chung M, Tawata S, Xuan TD. Allelopathy for weed management in sustainable agriculture. Perspective in Agri. Veterinary Sci. Nutrition and Natural Resources, 2007, 2(34).
12. Shettel NL, Balke NE. Plant growth response to several allelopathic chemicals. Weed Sci. 1983; 31:293-298.
13. Cheng F, Cheng Z. Research progress on the use of plant allelopathy in agriculture and the physiological and ecological mechanisms of allelopathy. 2015; 6:1020.
14. Nongmaithem D, Pal D, Ghosh RK. Weed control through smothering crops and use of plant extracts as bio herbicides. Indian J Weed Sci. 2012; 44(4):251-254.
15. Ghosh RK, Shamurailatpam D, Ghosh A, Sentharagai S, Labar A, Nongmaithem D *et al*. Use of botanical herbicides in system intensification. Indian J Weed Sci. 2015; 47(4):401-407.