Original Research Article

Integratedweedmanagement intransplantedrice*(Oryzasativa*L.*)*

ABSTRACT

Anexperimententitled"IntegratedWeedManagementintransplantedrice(*Oryzasativa* L.)" was conducted at ShradhayBhagwati Singh Agriculture Research Farm, Hajipur,Chandra Bhanu Gupta Post Graduate College,B.K.T.,LUCKNOW(U.P.)duringKharifseasonof 2022-2023. The treatment comprised of 9 weed management practices. Weedy check tillmaturity,Weedfreeupto60DAT,Pretilachlor50%EC@1.25kga.i/ha(PE),Pendimethaline30 % EC @1.0 kg a.i/ha (PE), Pendimethaline 30 % EC @ 1.0 kg a.i/ha + 1 hand weeding at30DAT, Pendimethaline 30 % EC @1.0 kg a.i/ha (PE) + Bispyribac Sodium 10 % SC @ 25 ga.i/ha (POE), Pretilachlor 50 % EC @1.0 kg a.i/ha + 1 hand weeding At 35DAT, Two handweeding at 20 and 40 DAT, Pretilachlor 5 0 % E C @ 1.0 kg a.i/ha (PE) + Bispyribac sodium10% SC @ 25 g a.i/ha (POE). Weed free upto 60 DAT resulted in significantly higher growth,yield attributes and yield over result of the treatments. The highest weed control efficiency wasrecorded with weed free upto 60 DAT. However, the highest weed Index was recorded withweedy check and lowest being with weed free upto 60 DAT. The highest net returns (Rs. 58,218.31/ha) was recorded by weed free upto 60 DAT and highest B:C ratio was recorded byPretilachlor50% EC@1.0kga.i/ha(PE)+BispyribacSodium 10% SC@ 25ga.i/ha(POE).

Keywords: Integrated weed management, growth, yield, economics andrice.

1. INTRODUCTION

Rice*(Oryzasativa*L.*)*belongstogramineaefamily.Itisthestablefoodformorethan60 %oftheworldpopulationandit'scultivationsecuresalivelihoodformorethan2billionpeople.Riceiswidelycultivatedin India andotherpartsofAsiasuchasChina,JapanandIndonesiaetc.Rice is oneof themostimportantdietarycarbohydratesintheworld.

Globally, India is being second large area under rice after China. During 2020-21,globally rice is cultivated on an area of 164.19 million hectares with an annual production ofaround499.6milliontonsandaverageproductivityof3042kg/ha.InIndia,Rice is grown on 45 million hectares area with production of 120 million tons with averageproductivityof2600kg/ha**[21]**.UttarPradeshisthelargestrice growing state after West Bengal where rice is grown on 5.81 million hectares with annualproductionof13.27milliontonswithaverageproductivityof22.83q/hawhichisconsideredtobe low as compared to the productivity of Punjab 43.66 q/ha, Haryana 31.81 q/ha and WestBengal 29.26q/ha **[2].**

Integratedweedmanagementsystembasicallyanintegrationofeffective,dependableandworkable weed management practices that can be used economically by the producers as a partof effective farm management system. This approach entirely takes into account the need toincrease agriculture production and reduce economical losses without any risk to human healthsimultaneouslyimprovingsafetyandqualityofenvironment.Theintegratedweedmanagement(IWM) this plays a vital role in transplanted rice cultivation, in order to reduce dependence onexcessive

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Comment [A2]: Include general objective at the beginning, Experimental design used, treatments (quantity and its repetitions), parameters evaluated, analyzes used and the most important results.

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Include results of other previous studies, in addition the general objective is not observed at the end of the introduction

chemical use, avoid environmental pollution and reduce weeding cost. There istherefore need to find out economically viable and widely accepted integrated weed controlmethodundertransplanted rice.

Weeds are competed with rice by their higher adaptability and fast growth, dominate thecrop habitat and reduces the yield potential of rice. Weeds are major biotic constraint to reducerice productivity in world wide. Control of weeds during the critical period of competition isessential for obtaining optimum rice yield. Prevention of weed competition and keeping weedfree environment at critical period of rice growth is necessary for successful rice production[**23].**Weedcompetitionisoneoftheprimeyieldlimitingconstraintsin rice resulting in yield reduction of 28-45 % **[11].** Uncontrolled weedgrowthduringearlystage(20–45DAT)ledtoreductioninyieldwasupto25-53%**.**Herbicidesofferthemosteffective,economicalandwayofweedmanagement **[22].** Hence, spray of herbicides are the best option tocontrolthemixedpopulationofweeds inricecrop.

2. METHODSANDMATERIALS

Afieldexperimentwascarriedduringkharifseasonof2022-2023atShradhyaBhagwatiSingh Agriculture Research Farm (Hajipur), Chandra Bhanu Gupta Post Graduate College, Bakshi ka talab, Lucknow, (U.P.)during kharif season 2022-2023. Theexperimental site is situated at 26.50º North latitude and 80.50º East longitude with an altitudeof 123 meters above mean sea level. The soil of experimental field was silty-loam texture,slightlyalkalineinreaction(8.00pH),mediuminorganiccarbon(0.70%)andurea(326kg/ha),phosphorus (173 kg/ha) and potassium (100 kg/ha). Nine treatments comprised of differentmethod of weed management practices with three replication. Nitrogen were applied throughureainwhichhalfdoseofNitrogenaspertreatmentwasappliedatthetimeof sowingandrest

Comment [A5]: Include geographic coordinates

More procedurally describe the experiment setup process so that readers can replicate the experiment

parameters evaluated?

used statistical analysis and software?

half does of nitrogen was applied at 30 DAT . A common dose of Phosphorus (80 kg P_2O_5 /ha)and potash (60 kg K_2O/ha) was applied at transplanting time to all plots. The Paddy variety(Rustum D 575) was sown inJune, using100 kg/ha seed at 20 cm apart rows and harvested infirst week of October . All improved packages of practices were followed to raise the crop. Thedata on plant height and tillers were recorded from the area already marked by tagged. Samplefordrymatter accumulationwasrecordedbycuttingofplants.Thefreshsamples werefirst sundried and then kept in electric oven at 65-70ºC till the constant dry weight attained. Yieldattributeswererecordedfrom5panicleselectedrandomlyfromeachplot.Grainandstrawyieldsof paddy were recorded at harvest the harvest index was calculated as grain yield divided bytotal biological yield and multiplied by hundred. The uptake of nutrients was calculated asnutrient content in grain and straw multiplied by respective yield. Economics of differenttreatments was worked out on the basis of prevailing market prices. The data so obtained onvariousparameterswereanalysedasperstandardstatisticalprocedures.ThecontentofN,P,andKingrainan d strawwas determinedusingstandardlaboratoryprocedures.

3. RESULTSANDDISCUSSION

3.1 WeedStudies

Thedifferentweedgrowthattributingcharactersasinfluencedbydifferenttreatmentwerepresented in Table No 1, in which Weed free upto 60 DAS recorded significantly lowest weeddensity and weed dry weight over rest of the treatments. While the highest weed density and weeddry weight was observed in weedy check at all stages of crop growth as compared to rest of thetreatments. Highest Weed Control efficiency (77.17%) was recorded with weed free upto 60DASwasmainlyduetoreductionintheweightoftheweedascomparedtoweedycheckwhich,recorded the lowest Weed Control efficiency (0.00 %). But, The lowest weed index under allweed management treatment over weed free upto 60 DAS was recorded due to efficient controlof weeds and higher grain yield, however the lower grain yield and higher weed dry weightcausedhigherweedindexinweedycheck.TheseresultswereinconformitywithAbbassiSh*etal*. [1] and Survase*et al*. [20] and Carter and Lvany [7].

Comment [A6]: Update references used. Improve reference format

Improve considering material and methods

Table1Effectofintegratedweedmanagementonweedgrowthparametersof paddy

Treatments	Weeddensity(Atharvest)	Weed dryweight(Atharvest)	Weedcontrol efficiency (%)	Weedindex(%)
T1:Weedychecktillmaturity	51.65	131.69	0.00	92.01
T2:Weedfreeupto60DAT	20.20	30.06	77.17	0.00
T3:Pretilachlor50%EC@1.25kga.i/ha(PE)	39.13	85.43	35.12	45.31
T4:Pendimethaline30%EC@1.0kga.i/ha(PE)	42.10	87.13	33.83	60.11
T5:Pendimethaline30%EC@1.0kga.i/h+1handweedingat 30DAT	31.13	77.16	41.40	14.25
T6:Pendimethaline30%EC@1.0kga.i/h(PE) +Bispyribac10%SC@25ga.i/h(POE)	36.06	81.20	38.34	23.14
T7:Pretilachlor50%EC@1.0kga.i/h+1handweedingat35DAT	30.30	67.23	48.94	11.62
T8:Twohandweedingat20and40DAT	29.23	34.26	73.98	3.97
T9:Pretilachlor30%EC@1.0kga.i/h(PE)+Bispyribac 10% SC@25ga.i/h(POE)	35.26	79.63	39.53	17.14
SEm±	0.50	0.82	-	-
CD(P=0.05)	1.52	2.52	-	-

3.2 Growthparameters

The different growth attributing characters as influenced by different treatment were presentedinTableNo2.Thesignificantlyhighestvaluesofallgrowthcharactersviz.plantheight,numberof tillers, dry matter accumulation and leaf area index at harvest were recorded with weed freeupto 60 DAS were significantly superior over rest of the treatments. This was might be due toeffective weed control which reduces the weed crop competition ultimately higher growth ofcrop.Thesignificantlylowestvaluesofallgrowthcharacterswereregisteredwithweedychecktreatment as weedy check plots having high intensity of weeds which suppressed growth ofPaddy.Theseresultswerein conformity withMirza*etal.* [12],Ali*etal*.[4]and Nayak*etal.* [16].

Table 2Effectofintegratedweedmanagementongrowthparametersofpaddy.

Treatments	Plantheight(cm)(Atharvest)	Numberoftillersm^{-2}(Atharvest)	Drymatteraccumulation(Atharvest)	Leafareaindex(Atharvest)
T1:Weedychecktillmaturity	110.33	478.00	688.33	6.00
T2:Weedfreeupto60DAT	118.60	529.00	703.76	7.52
T3:Pretilachlor50%EC@1.25kga.i/ha(PE)	113.30	519.00	700.63	6.52
T4:Pendimethaline30%EC@1.0kga.i/ha(PE)	112.66	518.00	699.43	6.44
T5:Pendimethaline30%EC@1.0kga.i/h+1handweedingat30DAT	115.43	526.00	702.60	6.88
T6 : Pendimethaline 30%EC @1.0kga.i/h(PE)+Bispyribac10%SC@25ga.i/h(POE)	114.20	523.00	701.20	6.62
T7:Pretilachlor50%EC@1.0kga.i/h+1handweedingat35DAT	117.50	527.00	702.80	7.33
T8:Twohandweedingat20and40DAT	117.66	528.00	703.50	7.46
T9: Pretilachlor 30%EC@1.0kga.i/h(PE) +Bispyribac10%SC@25ga.i/h(POE)	115.23	524.00	701.66	6.73
SEm±	0.60	0.63	0.61	0.16
CD= P(0.05)	1.82	1.93	1.84	0.48

3.3 Yieldparameters

The data presented in Tableno. 3 indicate that all the weed management practices weresignificantly affected and the yield contributing characters of paddy crop viz. No.of effectivetillers(474.33m^{-2}),lengthofpanicle(26.76cm),panicleweight(5.20g),numberofgrains/panicle(187.00),grainweight/panicle(5.16)andTestweight(24.30g)weresignificantlyhigher in weed free upto 60 DAS treatment. Thismay be due to good growth of paddy reflectsinyieldattributingcharactersasthesetreatmentshavecontrolsweedseffectively.Weedychecktreatment recorded significantly lowest values of yield contributing characters than rest oftreatments. Similar result were recorded by Hasanuzzaman *et. al.*[9] andBhurer*et.al*. [5].

3.4 Yieldstudies

The data presented in Table no. 3 indicate that the grain yield and straw yield were recordedsignificantly highest in weed free upto 60 DAS (48.10 q/ha and 58.23 q/ha) over rest oftreatments. Effective weed control achieved in these treatments resulted in enhancing variousgrowth and yield contributing characters of wheat and finally gave significantly higher grainyield and straw yield over weedy check. However weedy check recorded significantly lowestgrain yield and straw yield (25.05 q/ha and 49.03 q/ha) as compared to rest of the treatments.Similarfindings wererecordedbyNaik*et.al*.[15]

Table3Effectofintegratedweedmanagementonyieldparametersofpaddy.

Treatments	No.of effectivetillers(m^{-2})	Paniclelength(cm)	Panicleweight(g)	No. ofgrains/ panicle	Grainweight /panicle(g)	Testweight	Grainyield(q/ha)	Strawyield(q/ha)
T1:Weedychecktill maturity	422.00	15.60	3.20	86.00	2.15	19.74	25.05	49.03
T2:Weedfreeupto60DAT	474.33	26.76	5.20	187.00	5.16	24.30	48.10	58.23
T3:Pretilachlor50% EC@ 1.25kga.i/ha(PE)	463.00	17.83	4.34	122.00	2.47	20.62	33.10	51.10
T4:Pendimethaline30% EC@ 1.0kg a.i/ha(PE)	462.00	17.30	4.20	96.00	2.28	20.20	30.04	50.13
T5:Pendimethaline30%EC@1.0kg a.i/h+ 1hand weeding at 30DAT	470.00	23.40	4.84	154.00	3.64	22.90	42.10	54.40
T6: Pendimethaline30%EC @1.0kga.i/h(PE) + Bispyribac 10%SC@25ga.i/h (POE)	467.00	19.33	4.54	139.00	2.50	21.40	39.06	53.08
T7 : Pretilachlor50%EC@ 1.0kg a.i/h + 1handweedingat35DAT	472.00	24.16	4.95	173.00	3.94	22.96	43.09	55.03
T8 : Two handweedingat20and 40DAT	473.00	25.30	5.05	181.00	4.26	23.73	46.26	56.06
T9:Pretilachlor30%EC@1.0kg a.i/h (PE) +Bispyribac10%SC @25ga.i/h (POE)	468.00	19.56	4.73	144.00	2.91	21.79	41.06	54.33
SEm±	0.58	0.63	0.28	0.48	0.12	2.36	0.58	0.57
CD= P(0.05)	1.75	1.93	0.86	1.45	0.36	0.78	1.75	1.73

3.5 Nutrientuptake

The data presented in Table 4 indicate the nutrient uptake by crop in which weed free upto 60DASrecordedsignificantlyhighestuptake ofN,PandKthroughgrain(62.04,17.79and13.94kg/ha) and through straw (25.62, 16.30 and 68.71 kg/ha) respectively. However, among theherbicides treatments, the higher uptake of N, P and K through grain (56.66, 17.24 and 13.54kg/ha) and straw (24.99, 15.75 and 66.28 kg/ha) was recorded by pretilachlor 30%EC @1.0kga.i/h (PE) + Bispyribac 10% SC @ 25 g a.i/h (POE), while the lowest N,P and K uptake bythrough grain (38.32, 11.52 and 10.27 kg/ha) and straw (23.53, 15.68 and 62.26 kg/ha) wasrecordedby weedycheck.Similarfindingswererecordedby

Satapathy*et.al.* [18] andChakrabort*iet.al.* [8].

Table4Effectofintegratedweedmanagementonnutrientuptake (Kg/ha)bycrop

Treatments	GRAIN			STRAW		
	N	P	K	N	P	K
T1:Weedychecktillmaturity	38.32	11.52	10.27	23.53	15.68	62.26
T2:Weedfreeupto60DAT	62.04	17.79	13.94	25.62	16.30	68.71
T3:Pretilachlor50%EC@1.25kga.i/ha(PE)	49.31	14.56	12.90	24.01	15.70	63.87
T4:Pendimethaline30% EC@1.0kga.i/ha(PE)	45.36	13.51	12.01	23.56	15.69	63.16
T5: Pendimethaline30%EC@1.0kga.i/h+1handweedingat30DAT	57.67	17.26	13.64	25.02	15.77	66.31
T6:Pendimethaline30%EC@1.0kga.i/h(PE) +Bispyribac10%SC@25ga.i/h(POE)	54.68	16.79	13.28	24.94	15.71	65.81
T7:Pretilachlor50%EC@1.0kg a.i/h+1handweedingat35DAT	58.17	17.32	13.70	25.25	15.95	66.53
T8:Twohandweedingat20and40DAT	60.60	17.57	13.87	25.56	16.25	66.71
T9:Pretilachlor30%EC@1.0kga.i/h(PE)+Bispyribac10% SC@25ga.i/h(POE)	56.66	17.24	13.54	24.99	15.75	66.28
SEm±	0.19	0.22	0.20	0.25	0.19	0.31
CD= P(0.05)	0.58	0.68	0.63	0.76	0.55	0.93

4. **Economics**.

The data presented in Table 5 indicate the economics of crop in which weed free upto 60 DASaccrued the maximum gross income (121,416.00 Rs/ha) followed by two hand weeding at 20and 40 DAT. However, the highest net income (58,218.31 Rs/ha) was recorded withweed freeupto 60 DAS followed by two hand weeding at 20 and 40 DAT. The BCR recorded maximum(1.21) with pretilachlor 30% EC @1.0kg a.i/h (PE) + Bispyribac 10% SC @25ga.i/h (POE)followed bypendimethaline 30% EC @1.0kg a.i/ha (PE) + Bispyribac 10% SC @25g a.i/ha(POE)whenappliedwasmainlyattributedtohighergrainandstrawyieldproportionatelylowercost incurred. However, lower grain and straw yield resulted lower gross income, net incomeandBCRwithweedycheck.Similarresultwererecordedby Nivetha*et.al.* [17]and Jagtap*et.al.* [10].

Table5EffectofIntegratedweedmanagementonEconomics.

Treatments	Cost ofcultivation(Rs/ha)	Grossincome(Rs/ha)	Netincome(Rs/ha)	B:C ratio (Rs/Reinvested)
T1:Weedychecktillmaturity	45,197.69	70,714.00	25,516.31	0.56
T2:Weedfreeupto60DAT	63,197.69	121,416.00	58,218.31	0.92
T3 : Pretilachlor 50% EC@ 1.25kga.i/ha(PE)	46,422.69	87,964.00	41,541.31	0.89
T4:Pendimethaline30% EC@1.0kga.i/ha(PE)	46,897.69	81,333.60	34,435.91	0.73
T5:Pendimethaline30%EC@1.0kga.i/h+1handweedingat30DAT	55,297.69	107,644.00	52,346.31	0.94
T6:Pendimethaline30%EC@1.0kga.i/h(PE) + Bispyribac 10% SC @ 25ga.i/h(POE)	48,210.69	100,914.40	52,703.71	1.09
T7:Pretilachlor50% EC@1.0kga.i/h+1handweedingat 35DAT	54,697.69	109,915.60	55,217.91	1.00
T8:Twohandweedingat20and40DAT	58,697.69	116,794.40	58,096.71	0.98
T9:Pretilachlor30%EC@1.0kga.i/h(PE) +Bispyribac10% SC@25ga.i/h(POE)	47,610.19	105,494.40	57,884.21	1.21

5. CONCLUSION

It can be concluded from the present investigation that to get the higher growth, yield and netand gross monetary returns, paddy crop should be kept weed free. Weed free treatment controltheweedsmostefficiently,itreducedtheweeddrymatterresultedinincreaseinweedcontrol efficiency. But from economic point of view weed free treatment is not feasible to the farmersbecause of having a greater number of labours and high cost of cultivation which results in lessbenefit cost ratio. Whereas, among integrated weed management treatment pretilachlor 30%EC@1.0kga.i/h(PE)+Bispyribac10%SC@25ga.i/h(POE)iseffectivewithhigherbenefit:costratio(1.21) and can beused in paddy crop.

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