INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

YIELD PARAMETERS, YIELD AND ECONOMICS OF MACHINE TRANSPLANTED RICE (*ORYZA SATIVA* L.) AS INFLUENCED BY DIFFERENT WEED MANAGEMENT PRACTICES

Negalur, R.B., Halepyati, A.S. & Channabasavanna, A. S.
Agricultural Research Station, Gangavati, University of Agricultural Sciences, Raichur, Karnataka -583 227

ABSTRACT
Field experiment on "Studies on efficiency of different weed management practices in machine transplanted rice (*Oryza sativa* L.)" was conducted at Agricultural Research Station, Gangavati, University of Agricultural Sciences, Raichur, Karnataka during *kharif*, 2012 and 2013 under irrigated condition in clay soil. Pooled mean indicated that, among the different weed management practices, yield parameters *viz.*, number of panicles **(**383 m^{-2}), panicle length (20.33cm), number of grains per panicle (116.43), number of filled grains per panicle (104.32), lesser number of unfilled grains per panicle (12.12) filling per cent (89.59), thousand grain weight (18.29 g.) grain yield (5160 kg ha^{-1}), straw yield (6482 kg ha^{-1}) and significantly higher gross returns (Rs. 92,212 ha^{-1}), net returns (Rs. 43,176 ha^{-1}) and B:C of 2.07 over unweeded check and next only to weed free check. Pre emergent application of butachlor 50 EC @ 2.5 lit ha^{-1} fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space was found to be the most effective and economical.

KEYWORDS: Conoweeder, hand weeding, low land power operated paddy weeder, post emergent, pre-emergent, weed management.

INTRODUCTION

In Karnataka it is cultivated in command areas of Cauvery basin in South, Tungabhadra and Upper Krishna commands in North where transplanting is the major method of cultivation. In Northern Karnataka that too in Hyderabad - Karnataka region, major paddy area is concentrated in Koppal, Raichur, Yadgir and Bellary districts. The area under rice in Karnataka is 1.54 m ha with an annual production of 3.9 million tonnes and with a productivity of 2974 kg per ha (Anon, 2010).

During the early growth period of rice weed management is one of the most critical factor for successful production of rice. Weeds do grow faster and absorb the available nutrients earlier and faster resulting in deprivation of nutrients for the rice. Presently the conventional method of manual weeding is widely practiced as effective method of weed control. But, it is not advantageous as it is costlier, time consuming and labour may trample and damage rice seedlings while removing weeds. Manually it is difficult to differentiate and remove the grassy weeds, In such a situation, the chemical weed control becomes an alternative method for weed control. Chemical weeding preferably the application of pre-emergent herbicide is a vital tool for effective and cost efficient weed control in rice, which encounters weed competition from the day of germination. Adjusting the time of application, reducing the dose of the herbicide or use of herbicides in sequence can improve selectivity, timely and adequate weed control in transplanted rice. Manually operated cono weeder at various Universities in India showed that the implement reduced drudgery due to less time taken (50-55%) compared to hand weeding. The use of equipment also resulted in saving of cost of operation by 45%. Farmers are of the opinion that cono weeder operation in standing position of operator allowed weeding without fatigue (Dixit and Khan, 2009).

MATERIALS & METHODS

A field experiment was conducted at Agricultural Research Station, Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, during *kharif*, 2012 and 2013. The experiment was laid in strip-plot design. The soil of the experimental site was medium deep black clay with soil reaction (8.2), electrical conductivity (2.1) determined following the procedure given by Jackson (1973), available N (247.2 kg ha^{-1}) Subbaiah and Asija (1956), available P_2O_5 (50.2 kg ha^{-1}) Olsen *et al.* (1954) and available K_2O (357.6 kg ha^{-1}) Jackson (1973) at surface 0-20 cm soil depth. Agricultural Research Station, Gangavathi is situated in the Northen Dry Zone of Karnataka between 15° 15' 40" North latitude and 76° 31' 40" East longitude at an altitude of 419 m above mean sea level and represents irrigated transplanted rice belt of Tungabhadra command area. The experiment consisted twelve different weed management practices *viz*., pre-emergent application of butachlor 50 EC fb hand weeding at 30 DAT (T_1), Bensulfuron methyl 0.6% + Pretilachlor 6% fb hand weeding at 30 DAT (T_2), Butachlor 50 EC fb 2, 4-D Sodium salt 80 WP at 25 DAT (T_3), Butachlor 50 EC fb Bispyriback sodium 10 SC at 25 DAT (T_4), Bensulfuron methyl 06% + Pretilachlor 6% fb 2, 4 - D fb Sodium salt 80 WP at 25 DAT (T_5), Bensulfuron methyl 0.6% + Pretilachlor 6% fb Bispyriback sodium 10 SC 25 DAT (T_6), Butachlor 50 EC fb power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space (T_7), passing of power operated low land

rice weeder at 20 and 30 DAT with hand weeding in intra row space (T_8), passing of Conoweeder twice at 10 and 20 DAT fb hand weeding at 30 DAT (T_9) and two hand weedings at 20 and 40 days after transplanting (T_{10}) were compared with unweeded control (T_{11}) and weed free check (T_{12}). The land was prepared using tractor drawn cultivator twice, followed by puddling twice with disc puddler and finally levelled using tractor drawn spike tooth harrow and kept ready for planting. Weed control treatments were imposed as per the combination of pre, post emergent herbicides and use of weeders, time and dosage of the chemicals. Recommended package of practices were followed and need based pesticide sprays were taken up. The crop was harvested at physiological maturity, threshed and cleaned manually in both the years. The weed count of different weeds from 0.25 squre meter area was recorded at 20 days interval and then the weeds after washing in water were sun dried and then oven dried at 65ºC and the dry weight of weeds were recorded and expressed in grams. Both grain and straw were sun dried for a week and dry weights were recorded. For computing the cost of cultivation, different variable cost of items was considered. The cost includes expenditure on seeds, fertilizer, weedicides, irrigation, plant protection chemicals, hiring charges of transplanter, conoweeder, low land power operated paddy weeder, fuel cost and labour charges prevailed in market during 2012 and 2013.

RESULTS & DISCUSSION

Yield and Yield parameters

Yield and yield parameters of rice crop were influenced significantly by different weed management practices. Weed free check recorded significantly higher values of all most all the yield parameters. Among the various weed management practices, significantly higher number of panicles **(**383 m^{-2}), panicle length (20.33 cm), number of grains per panicle (116.43), number of filled grains per panicle (104.32), filling per cent (89.59), thousand grain weight (18.29 gram) grain yield (5160 kg ha^{-1}) and straw yield (6482 kg ha^{-1}) were recorded with application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces (Table 1, 2 & 3).

TABLE 1. Number of panicles, panicle length and number of grains $panicle^{-1}$ as influenced by weed control treatments in machine transplanted rice

Treatments	Number of panicles m^{-2}			Panicle length (cm)			Number of grains $panicle^{-1}$		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
T_1	333	342	338	17.37	17.61	17.49	91.70	97.70	94.70
T_2	339	348	344	17.60	17.86	17.73	93.63	99.63	96.63
T_3	341	350	346	17.80	18.04	17.92	95.20	101.20	98.20
T_4	347	356	352	18.10	18.34	18.22	98.23	104.23	101.23
T_5	368	377	373	19.23	19.46	19.35	107.10	113.10	110.10
T_6	373	382	378	19.63	19.91	19.77	108.63	114.63	111.63
T_7	378	387	383	20.22	20.44	20.33	113.43	119.43	116.43
T_8	355	364	360	18.63	18.89	18.76	102.87	108.90	105.89
T_9	358	367	363	18.77	19.01	18.89	104.13	110.13	107.13
T_{10}	353	362	358	18.32	18.56	18.44	100.53	106.53	103.53
T_{11}	220	229	225	16.73	16.96	16.85	83.23	89.23	86.23
T_{12}	389	398	394	21.03	21.38	21.21	117.80	123.80	120.80
S.Em.±	14.87	14.85	18.43	0.69	0.74	0.87	4.12	4.26	4.13
C.D. (P=0.05)	43.57	44.12	54.21	2.05	2.19	2.55	12.13	12.53	12.19

TABLE 2. Number of filled grains $panicle^{-1}$, unfilled grains $panicle^{-1}$ and grain filling per cent as influenced by weed control treatments in machine transplanted rice.

Treatments	No. of filled grains $panicle^{-1}$			No. of unfilled grains $panicle^{-1}$			Grain filling per cent		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
T_1	76.02	82.00	79.01	16.78	16.73	16.76	82.92	83.95	83.44
T_2	78.38	84.00	81.19	15.00	15.00	15.00	84.24	85.18	84.71
T_3	80.20	86.20	83.20	15.68	15.70	15.69	82.90	83.93	83.42
T_4	81.45	87.50	84.48	15.25	15.63	15.44	83.71	84.31	84.01
T_5	94.20	100.20	97.20	12.90	12.93	12.90	87.96	88.59	88.28
T_6	96.23	102.23	99.23	12.40	12.50	12.45	88.59	89.18	88.89
T_7	101.33	107.30	104.32	12.10	12.13	12.12	89.33	89.84	89.59
T_8	88.92	94.90	91.91	13.95	14.00	13.98	86.44	87.14	86.79
T_9	90.63	96.60	93.62	13.50	13.53	13.52	87.04	87.71	87.38
T_{10}	86.08	92.10	89.09	14.45	14.43	14.44	85.63	86.45	86.04
T_{11}	67.03	73.00	70.02	17.20	17.23	17.22	80.54	81.81	81.18
T_{12}	107.10	113.13	110.12	10.70	10.67	10.69	90.92	91.38	91.15
S.Em.±	3.22	3.11	2.36	0.96	0.96	0.95	1.51	1.64	1.67
C.D. (P=0.05)	9.47	9.16	6.95	2.81	2.82	2.81	4.49	4.75	4.86

However it was found to be on par with application of bensulfuron methyl 0.6% + pretilachlor 6% fb bispyriback sodium 10 SC and bensulfuron methyl 0.6% + pretilachlor 6% fb 2,4 -D sodium salt 80 WP over unweeded control. The highest grain yield of rice in weed free check and with the application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces was mainly due to

minimum crop-weed competition throughout the crop growth period, thus enabling the crop for maximum utilization of nutrients, moisture, light and space, which influenced growth and yield components. Better yield can be obtained when the yield attributing parameters like number of panicles per square meter, panicle length, number of grains panicles^{-1}, filled grains panicles^{-1} and grain filling per cent are higher. All these enhanced yield attributing parameters were recorded with application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces next only to weed free check over unweeded control. The lower yield attributes recorded with unweeded control was due to severe competition exerted by weeds for space, light and more importantly for nutrients throughout the crop growth period as reported by Choudhary and Thakuria (1998). Similar findings were also reported by Sathyanarayana *et al*. (1997), Behera and Jena (1998) and Walia *et al*. (2008).

TABLE 3. Thousand seed weight, grain yield and straw yield as influenced by weed control treatments in machine transplanted

Treatments	Thousand seed weight (g)			Grain yield (kg ha^{-1})			Straw yield (kg ha^{-1})		
	2012	2012	pooled	2012	2013	pooled	2012	2013	pooled
T_1	17.14	17.33	17.24	4380	4462	4421	5515	5607	5561
T_2	17.49	17.65	17.57	4490	4571	4531	5685	5679	5682
T_3	17.55	17.70	17.63	4540	4622	4581	5715	5726	5721
T_4	17.67	17.82	17.75	4610	4692	4651	5890	5884	5887
T_5	18.18	18.30	18.24	4893	4975	4934	6240	6301	6271
T_6	18.18	18.34	18.26	5083	5167	5125	6345	6406	6376
T_7	18.21	18.37	18.29	5119	5200	5160	6450	6514	6482
T_8	17.90	18.05	17.98	4737	4818	4778	6014	6071	6043
T_9	18.07	18.25	18.16	4803	4885	4844	6117	6177	6147
T_{10}	17.83	17.99	17.91	4682	4763	4723	6010	6008	6009
T_{11}	17.02	17.20	17.11	3145	3225	3185	3835	3896	3866
T_{12}	18.30	18.45	18.38	5284	5366	5325	6567	6628	6598
S.Em.±	0.39	0.42	0.41	135	134	135	189	190	189
C.D. (P=0.05)	1.14	1.23	1.22	396	395	396	555	558	557

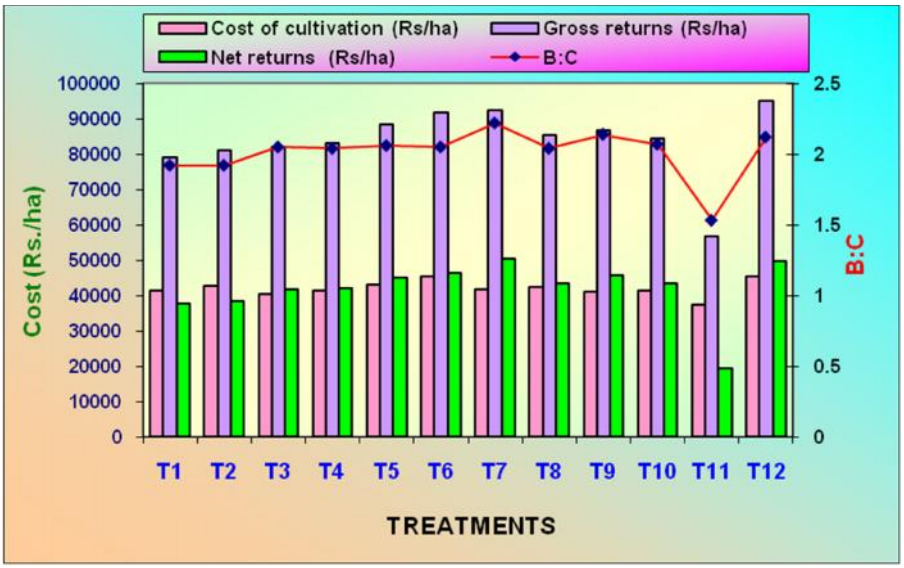

FIGURE 1. Economics of machine transplanted rice as influenced by different weed control treatments

Economics

Significant variations with respect to economics were noticed with different weed management treatments. Weed free check recorded significantly higher gross returns (Rs. 95,105) when compared to rest of the treatments but was found to be on par with application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces (Rs. 92,212), bensulfuron methyl 0.6% + pretilachlor 6% fb bispyriback sodium 10 SC (Rs. 91,549) and bensulfuron methyl 0.6% + pretilachlor 6% fb 2,4 -D sodium salt 80 WP (Rs. 88,229). Whereas net returns were higher with application of butachlor 50EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces (Rs. 50,410) compared to unweeded control (Rs.19,376) and it was followed by weed free check (Rs. 49,801) and bensulfuron methyl 0.6% + pretilachlor 6% fb bispyriback sodium 10 SC (Rs. 46,253) (Table 4). Even though the gross returns were the highest with weed free check, the net returns were higher with application of butachlor 50EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space, which is because of higher cost of cultivation due to manual

weeding when compared to cost incurred for herbicide and power weeder. Higher B:C (2.22) was noticed with application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces as compared to weed free check. However, in weed free check, the B:C (2.12) was lesser even though the grain yield and gross returns were higher (Table 4). This was due to higher cost of cultivation as a result of high cost incurred towards labour for weeding. Due to the severe crop weed competition throughout the crop growth period which ultimately resulted in decreased growth and yield contributing parameters, the unweeded control recorded significantly the lowest B:C (1.53). These results are in conformity with the findings of Sunil *et al.* (2010) and Pasha *et al.* (2012).

TABLE 4. Gross returns, net returns and benefit cost ratio as influenced weed control treatments in machine transplanted rice

Treatments	Gross returns (Rs. ha-1)			Net returns (Rs. ha-1)			Benefit: Cost		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
T_1	82149	75878	79013	43497	31630	37564	2.13	1.71	1.92
T_2	84231	77679	80955	44516	32158	38337	2.12	1.71	1.92
T_3	85149	78533	81841	47843	35461	41652	2.28	1.82	2.05
T_4	86514	79779	83147	48178	35753	41966	2.26	1.81	2.04
T_5	91818	84641	88229	51625	38585	45105	2.28	1.84	2.06
T_6	95301	87797	91549	54625	37880	46253	2.34	1.76	2.05
T_7	96012	88411	92212	57206	43613	50410	2.47	1.97	2.22
T_8	88874	81945	85410	49467	36884	43176	2.26	1.82	2.04
T_9	90124	83102	86613	52253	39228	45741	2.38	1.89	2.14
T_{10}	87882	81014	84448	49477	36888	43183	2.29	1.84	2.07
T_{11}	58911	54717	56814	24269	14483	19376	1.70	1.36	1.53
T_{12}	99052	91158	95105	57196	42405	49801	2.37	1.87	2.12
S.Em.±	2558	2325	2430	1536	1250	1358	0.03	0.02	0.02
C.D. (P=0.05)	7524	6839	7148	4518	3677	3995	0.08	0.05	0.07

CONCLUSION

The study on weed management practices in machine transplanted rice clearly indicated that, application of pre emergent herbicide butachlor 50 EC @ 2.5 lit ha^{-1} fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space was found to be most effective and economical.

REFERENCES

Anonymous (2010) *The Hindu Survey of Indian Agric*., pp. 43-46.

Behera, A.K. & Jena, S.N. (1998) Weed control in direct seeded rainfed upland rice. *Indian J. Agron*., **43**(2): 284-290.

Choudhary, J.K. & Thakuria, R.K. (1998) Evaluation of herbicide in wet seeded late Sali (winter) rice (*Oryza sativa* L.) in Assam. *Indian J. Agron*., 43(2): 291- 294.

Dixit, A. & Khan, J.N. (2009) Improved cost effective implements for small rice farmers. *Agricultural Mechanization in Asia, Africa and Latin America*, **40**(2): 30-35.

Jackson, M.L. (1973) *Soil Chemical Analysis*, (Ed.). Prentice-Hall of India, Pvt. Ltd., New Delhi, pp. 121-125.

Pasha, L.M., Krishna, L., Bhadru, D. & Naik, R.B.M. (2012) Comparative performance of different weed management practices in system of rice intensification. *Madras Agric. J.*, **99**(7-9):473-475.

Sathyanarayana, V., Latchanna, A. & Varaprasad, P.V., (1997) Weed management in direct seeded upland paddy. *Ann. Agric. Res*., **18**(3): 385-387.

Subbaiah, B.V. and Asija, G.L. (1956) Rapid procedure for determination of available nitrogen in soils. *Current. Sci.*, 31: 196.

Sunil, C.M., Shekara, B.G., Kalyanamurthy, K.N. & Shankara Lingappa (2010) Growth and yield of aerobic rice as influenced by integrated weed management practices. *Indian J. Weed Sci*., **42**(3 & 4): 180-183.

Walia, U.S. Bhullar, M.S., Shelly Nayyar & Walia, S.S. (2008) Control of complex weed flora of dry-seeded rice with pre-and post-emergence herbicides. *Indian J. Weed Sci.*, **40** (3&4): 161-164.