WEED AND NITROGEN MANAGEMENT IN AEROBIC RICE

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ABSTRACT

An investigation was carried out during kharif 2014 to 2016 at Instructional Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari to study the weed and nitrogen management in aerobic rice cv. NAUR-1. The results revealed that higher number of grains per panicle, grain yield and straw yield were recorded under the treatment of two hand weeding along with the application of 120 kg N/ha (W_5N_3) which was statistically at par with pretilaclor + bispyribac sodium salt along with application of 120 kg N/ha (W_3N_3) and pendimethalin + bispyribac sodium salt along with the application of 120 kg N/ha (W_4N_3). Significantly the highest dry weight of weed was recorded under un-weeded control along with the application of 120 kg N/ha (W_6N_3) while lower dry weight of weed was observed under two hand weeding along with 80 kg N/ha (W_5N_1) and it remained statistically at par with pretilaclor + bispyribac sodium salt along with the application of 80 kg N/ha (W_3N_1) and pendimethalin + bispyribac sodium salt along with the application of 80 kg N/ha (W_4N_1).

KEY WORDS: Aerobic rice, nitrogen levels, productivity, weed management

INTRODUCTION

Direct seeded rice is becoming popular as it is cheaper alternative to transplanting which avoids the puddling and maintain continuous moist soil condition and thus reduces the overall water demand for rice. It is the method of cultivation where the rice crop is established by direct seeding. Ponding is not done in aerobic rice. It is irrigated similar to other up land cereal crops and is suitable for water scare environment (Xiaoguang *et al*., 2005). Aerobic rice requires 30-50 per cent less water (Bouman and Toung, 2001). Supplementary irrigation is applied as and when required in the same way as in cereal crops like maize and wheat (Bouman *et al*., 2005)

The productivity of the direct seeded rice is often reported to be lower, mainly due to problems associated with weed management. The prevailing climatic and edaphic conditions are highly favourable for numerous species of weed that strongly compete with the rice crop. Weed share the plants in nutrition and water, carry insect pests and diseases, lower the quality of produce and sometimes cause complete

failure of the main crop. So, it is imperative to look into the ways to control weed. Now a day, the use of herbicides is gaining popularity in rice crop due to their rapid effects and lower costs compared to traditional methods.

Further, the decrease in grain yield, however, be averted with the use of fertilizers as a source of plant nutrition. Rana *et al.* (2000) reported that management of weed along with fertilizers decreased crop weed competition and increased net income by reducing losses due to weed, increasing fertilizer use efficiency and finally the grain yield. Therefore, need to explore the efficacy of the method of controlling weed with the application of fertilizers for augmenting the crop yield. Hence, the present study was conducted to determine the effect of a suitable weed control methods on rice yield without deteriorating the soil nutrition under south Gujarat condition.

MATERIALS AND METHODS

An investigation was carried out during *kharif* 2014 to 2016 at Instructional Farm, N.M. College of Agriculture, Navsari Agricultural University, Navsari to study the the effect of different weed treatments and nitrogen levels on yield and yield attributes of rice. *cv*. NAUR-1. Total eighteen treatment combinations consisting of six treatments of weed management [W_1 - Pretilaclor 0.75 kg/ha (Pre-emergence), W_2 - Pendimethalin 1.0 kg/ha (Pre-emergence). W_3 - Pretilaclor 0.75 kg/ha (Pre-emergence) + Bispyribac sodium salt 0.05 kg/ha (Post-emergence), W_4 - Pendimethalin 1.0 kg/ha (Pre-emergence) + Bispyribac sodium salt 0.05 kg/ha (Post-emergence), W_5 - Weed free (two hand weeding at 20 and 40 DAT) and W_6 – unweeded control] and three levels of nitrogen [N_1- 80 kg/ha, N_2 -100 kg/ha and N_3-120 kg/ha] were tried in this investigation using factorial RBD design. The experimental soil was clayey in texture, slightly alkaline in reaction (pH 8.1), low in available nitrogen (242 kg/ha), medium in available phosphorous (41 kg/ha) and high in available potassium (445 kg/ha). The aerobic rice *cv*. NAUR-1 was sown on 21st June in 2014, 15th June in 2015 and 21st June in 2016. The plot size was 5.0 x 4.0 m, row spacing was 20×15 sq.cm and regarding fertilizer management, FYM @ 10 tons per ha and P_2O_5 @ 30 kg/ha were applied as a common basal dose, whereas an application of nitrogen as per treatments were applied in three splits (40% N as basal, 40% at tillering and 20% at panicle initiation). Weed management was carried out as per treatments. The data on monocot, dicot and sedges weed population were subjected to square root transformation before statistical analysis to normalize their distribution (Panse and Sukhatme, 1978). The crop was harvested at full physiological maturity, sun dried for a week and threshed manually. All the biometrical observations on crop and weeds were observed as per the standard practices. Economics of different treatments were calculated taking into prevailing minimum support prices of inputs used and output obtained from each treatment. The total rainfall received during crop period was 1539 mm, 1227 mm and 1411 mm in 2014, 2015 and 2016, respectively.

RESULT AND DISCUSSION

Weed study

The data presented in Table 1 revealed that different weed management treatments had exerted significant influence to control monocot and dicot weed population. Significantly the highest monocot and dicot weeds population was observed under unweeded control treatment, while it was lower under pre-emergence application of pretilaclor 0.75 kg/ha (W_1) followed by pendimethalin 1.0 kg/ha (W_2), which was statistically at par with the treatments of post emergence applications of Pretilaclor 0.75 kg/ha (Pre-emergence) +

Bispyribac sodium salt 0.05 kg/ha (W_3) and Pendimethalin 1.0 kg/ha (Pre-emergence) + Bispyribac sodium salt 0.05 kg/ha (W_4) at 20 DAS, 40 DAS and at harvest. The data in Table 1 showed that none of the treatments and treatment combinations found significant for controlling sedges population at 20 DAS, 40 DAS and at harvest.

The data presented in Table 1 showed that different weed management treatments exerted significant effect on dry weight of weed. Significantly the highest dry weight of weed was recorded under unweeded control (W_6), while lower dry weight of weed was observed under weed free (two hand weeding at 20 and 40 DAT) and W_6 – unweeded control] treatment (W_5), which was statistically at par with the treatments of post emergence application of Pretilaclor 0.75 kg/ha(Pre-emergence) + Bispyribac sodium salt 0.05 kg/ha (W_3) and Pendimethalin 1.0 kg/ha (Pre-emergence) + Bispyribac sodium salt 0.05 kg/ha (W_4) at 20 DAS, 40 DAS and at harvest.

Different nitrogen levels failed to exert any significant influence on dry weight of weed at 20 DAS, 40 DAS and at harvest. However, among treatment combinations, data presented in Table 3 showed that significantly the highest dry weight of weed was recorded under unweeded control along with 120 kg N/ha (W_6N_3), while lower dry weight of weed was recorded under two hand weeding along with 80 kg N/ha (W_5N_1) and it remained statistically at par with W_4N_1, W_3N_1, W_5N_2, W_4N_2, W_3N_2, W_2N_2, W_5N_3, W_4N_3 and W_3N_3.

From Table 1, it was observed that the lowest weed index and weed control efficiency was achieved under application of pendimethalin + bispyribac sodium salt (W_4) followed by pretilaclor + bispyribac sodium salt (W_3). In case of nitrogen levels, the lowest weed index and weed control efficiency was noted under application of 120 kg N/ha (N_3) and it was the highest under the application of 80 kg N/ha (N_1).

Thus, different weed management treatments exerted significant effect on control of monocot and dicot weed population as well as on reduction of dry weight of weed compared to unweeded control (W_6). Similar findings are reported by Jana (2012) and Singh *et al.* (2008).

Crop study

Growth attributes

Plant height (cm)

Data presented in Table 2 revealed that application of 120 kg N /ha recorded significantly the highest plant height of 30.8 cm and significantly the lowest plant height recorded with 80 kg N /ha (29.3 cm) at 30 DAS. Different weed treatments and interaction effects for plant height at 30 DAS was found non-significant. At 60 DAS, significantly the maximum plant height was recorded with application of pretilaclor + bispyribac sodium salt (W_3), which was statistically at par with pendimethalin + bispyribac sodium salt (W_4) and two hand weeding (W_5), while significantly the lowest plant height was recorded under unweeded control (W_6). Significantly the maximum plant height was recorded with 120 kg N /ha and significantly the lowest was observed with 80 kg N /ha (N_1) at 60 DAS. Interaction effect for plant height at 60 DAS was non-significant.At harvest, significantly the maximum plant height was recorded with two hand weeding (W_5) which was statistically at par with pretilaclor + bispyribac sodium salt (W_3) and pendimethalin + bispyribac sodium salt (W_4), while significantly the lowest plant height was recorded under unweeded control (W_6). Significantly the maximum plant height was recorded with 120 kg N /ha (N_3) and the lowest was observed with 80 kg N /ha (N_1) at harvest.

Data presented in Table 3 indicated that significantly the higher plant height was recorded with pendimethalin + bispyribac sodium salt along with 120 kg N/ha (W_4N_3) which was statistically at par with two hand weeding along with 120 kg N/ha (W_5N_3) and pretilaclor + bispyribac sodium salt along with 120 kg N/ha (W_3N_3). Significantly the lower plant height was recorded with unweeded control along with 80 kg N/ha (W_6N_1) and it remained at par with W_6N_2. The results are in line with those of Jana (2012) and Singh *et al.* (2008).

Number of tillers

The data presented in Table 2 indicated that significantly the higher number of tillers were recorded with pendimethalin + bispyribac sodium salt (W_4) but the results were statistically at par with two hand weeding (W_5) and pretilaclor + bispyribac sodium salt (W_3). Significantly the lowest number of tillers was recorded under unweeded control (W_6). Significantly the highest number of tillers were recorded with 120 kg N/ha and the lowest with 80 kg N/ha at 60 DAS and harvest.

Different weed management practices had significantly influenced the growth parameters. Significantly the higher number of tillers were recorded with two hand weeding (W_5) which was statistically at par with pretilaclor + bispyribac sodium salt (W_3) and pendimethalin + bispyribac sodium salt (W_4). Significantly the lowest number of tillers were recorded under unweeded control (W_6) along with 80 kg N /ha (N_1) at 60 DAS and harvest. The results are in line with those of Jana (2012) and Singh *et al.* (2008).

Yield and yield attributes

Number of panicles per m^2 and Panicle length at harvest (cm)

Data presented in Table 2 revealed that significantly the higher number of panicles and length of panicle were recorded with pendimethalin + bispyribac sodium salt (W_4) but the results were statistically at par with two hand weeding (W_5) and pretilaclor + bispyribac sodium salt (W_3). Significantly the lowest number of panicles and length of panicle were recorded under unweeded control (W_6). Significantly the highest number of panicles and length of panicle were recorded with 120 kg N/ha and the lowest with 80 kg N/ha.

Number of grains per panicle, grain yield (kg/ha) and straw yield (kg/ha)

Data presented in Table 2 indicated that significantly the higher number of grains per panicle, grain yield and straw yield was recorded with two hand weeding (W_5) which was statistically at par with pendimethalin + bispyribac sodium salt (W_4). Significantly the lowest number of grains per panicle, grain yield and straw yield was recorded under unweeded control (W_6). Significantly the highest number of grains per panicle, grain yield and straw yield was recorded with 120 kg N/ha and the lowest with 80 kg N/ha.

Significantly the higher number of grains per panicle, grain yield and straw yield were recorded with two hand weeding along with 120 kg N/ha (W_5N_3) which were statistically at par with pretilaclor + bispyribac sodium salt along with 120 kg N/ha (W_3N_3), pendimethalin + bispyribac sodium salt along with 120 kg N/ha (W_4N_3) followed W_3N_2, W_4N_2,W_5N_2 and W_4N_1. Significantly the lowest number of grains per panicle, grain yield and straw yield was recorded under unweeded control along with 80 kg N/ha (W_6N_1) which was statistically at par with W_6N_2, W_6N_3, W_1N_1 and W_2N_1 (Table 3). Different weed management practices and higher nitrogen level had exerted significant and positive influence on yield and yield parameters. It might be due to better control of weeds increased nutrient utilization and reduced crop weed

competition resulted in better growth and development of rice plant and ultimately yield. These findings are in conformity with the findings of Singh *et al.* (2008) and Mishra and Singh (2008).

Biochemical study

Nitrogen content (%)

Data presented in Table 2 revealed that different weed management treatments, nitrogen levels and their interaction effects failed to exert any significant effect on nitrogen content (%) of aerobic rice.

Nitrogen uptake (kg/ha) and Nitrogen Use Efficiency (%)

Data presented in Table 2 showed that significantly the higher nitrogen uptake and nitrogen use efficiency was recorded with two hand weeding (W_5) which was statistically at par with pendimethalin + bispyribac sodium salt (W_4). Significantly the lowest nitrogen uptake and nitrogen use efficiency was observed under unweeded control (W_6). Significantly the highest nitrogen uptake and nitrogen use efficiency was recorded with 120 kg N/ha and the lowest with 80 kg N/ha. Interaction effect failed to exert any significant effect on nitrogen uptake by aerobic rice.

Significantly the higher nitrogen use efficiency was recorded with two hand weeding along with 120 kg N/ha (W_5N_3) but the result was statistically at par with pendimethalin + bispyribac sodium salt along with 120 kg N/ha (W_4N_3). Significantly lower nitrogen use efficiency was recorded under unweeded control along with 80 kg N/ha (W_6N_1) which was statistically at par with W_6N_2 (Table 3).

Quality study

Protein content (%)

Data presented in Table 2 revealed that different weed management treatments, nitrogen levels and their interaction effects failed to exert any significant effect on protein content (%) of aerobic rice.

Economics

Economics of different treatment combinations under study are presented in Table 4. The maximum net realization and BCR was achieved under treatment combination of two hand weeding along with 120 kg N/ha (W_5N_3) followed by pretilaclor + bispyribac sodium salt along with 120 kg N/ha (W_3N_3) and pendimethalin + bispyribac sodium salt along with 120 kg N/ha (W_4N_3). Under unweeded control along with different nitrogen levels had the least net realization and BCR.

CONCLUSION

For getting higher yield and net realization with efficient weed control, aerobic rice should be fertilized with 120 kg nitrogen/ha in three splits (40% N as basal, 40% at tillering and 20% at panicle initiation) along with two hand weeding at 20 and 40 DAS. Taking in to consideration the difficult situation of manual weeding, the treatment W_3N_3 [pretilaclor 0.75 kg/ha (pre-emergence) + bispyribac sodium salt 0.05 kg/ha (post-emergence) along with 120 kg nitrogen/ha in three splits (40% N as basal, 40% at tillering and 20% at panicle initiation)] was found more viable. During residue analysis different weedicides residues were found below detectable level in soil and rice grain samples.

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Table 1: Effect of weed management and nitrogen levels on monocot, dicot and sedges weed population (nos./m^2), dry weight of weed (g), weed index, weed control efficiency (%) in aerobic rice (pooled data)

Treatments	Monocot Weed Population (Nos./m^2)			Dicot Weed Population (Nos./m^2)			Sedges Population (Nos./m^2)			Dry Weight of Weed (g) Per Net Plot			Weed Index	Weed Control Efficiency (%)
	20 DAS	40 DAS	At harvest	20 DAS	40 DAS	At harvest	20 DAS	40 DAS	At harvest	20 DAS	40 DAS	At harvest		
Weed Management														
W_1	2.04 (3.44)	3.89 (14.5)	3.58 (12.0)	1.864 (1.711)	4.026 (15.593)	3.827 (13.926)	0.975 (1.319)	1.747 (2.284)	1.722 (2.296)	6.722	48.622	53.963	30.4	73.5
W_2	2.14 (3.78)	4.07 (16.1)	3.80 (13.8)	1.986 (1.932)	4.002 (15.296)	3.809 (13.741)	1.270 (1.417)	1.760 (2.185)	1.667 (1.852)	8.277	47.137	54.859	24.4	73.1
W_3	2.02 (6.05)	3.54 (12.3)	3.47 (11.5)	1.873 (1.893)	3.315 (10.481)	3.191 (10.037)	1.148 (1.380)	1.779 (2.321)	1.746 (2.506)	7.396	37.726	42.804	13.7	79.0
W_4	2.08 (3.56)	3.57 (12.8)	3.53 (12.1)	1.865 (1.820)	3.273 (10.148)	3.272 (10.444)	1.072 (1.407)	1.692 (2.000)	1.667 (1.889)	7.652	34.952	42.122	3.0	79.3
W_5	4.73 (33.03)	3.70 (13.9)	3.58 (12.9)	2.104 (10.269)	3.165 (9.519)	3.056 (9.000)	1.000 (1.375)	1.622 (1.741)	1.347 (1.519)	35.670	34.648	39.993	0.0	80.4
W_6	6.79 (46.82)	7.80 (62.3)	7.49 (57.8)	4.248 (13.296)	5.806 (33.222)	5.828 (33.444)	1.074 (1.405)	1.865 (2.593)	1.903 (2.741)	41.644	125.685	203.919	72.9	0.0
S.Em ±	0.505	0.324	0.378	0.242	0.274	0.285	0.06	0.079	0.060	5.827	11.403	4.353		
CD (P=0.05)	1.590	1.021	1.189	0.764	0.863	0.897	NS	NS	NS	18.361	35.930	13.717		
N Levels														
N_1	3.58 (17.04)	4.42 (21.5)	4.20 (19.6)	2.598 (5.195)	3.835 (14.778)	3.798 (14.685)	0.870 (1.336)	1.699 (1.981)	1.644 (1.815)	16.396	52.850	70.648	31.8	65.4
N_2	3.64 (18.17)	4.38 (21.6)	4.21 (19.7)	2.612 (5.404)	3.843 (15.019)	3.776 (14.685)	0.907 (1.346)	1.712 (2.056)	1.712 (2.037)	18.205	52.813	71.931	25.3	64.7
N_3	3.69 (18.30)	4.49 (22.8)	4.31 (20.7)	2.760 (5.793)	4.116 (17.333)	3.917 (15.926)	1.258 (1.470)	1.820 (2.426)	1.770 (2.241)	19.079	58.722	76.250	15.1	62.6
S.Em.±	0.071	0.058	0.061	0.058	0.074	0.064	0.044	0.047	0.041	0.659	2.104	1.777		
CD (P=0.05)	NS	NS	NS	NS	0.208	NS	NS	NS	NS	1.852	NS	NS		
W x N														
S.Em ±	0.165	0.136	0.145	0.133	0.178	0.150	0.102	0.110	0.095	1.544	4.867	4.157		
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	11.669		
CV %	13.92	9.79	10.72	15.94	14.00	12.32	23.64	20.0	17.64	26.93	28.21	17.93		

Note : Figures outside brackets are square root transformed values $\sqrt{X+1}$ ***and inside are original values***

Table 2: Effect of weed management and nitrogen levels on plant height (cm), number of tillers/m^2, number of panicles/m^2, panicles length (cm), number of grains/panicle, grain yield (kg/ha), straw yield (kg/ha), nitrogen use efficiency (%), nitrogen content (%), protein content (%), nitrogen uptake (kg/ha) of aerobic rice (pooled data)

Treatments	Plant Height (cm)			Number of Tillers/m^2		Number of Panicles/m^2	Panicles Length (cm)	Number of Grains /Panicle	Grain Yield (kg/ha)	Straw Yield (kg/ha)	Nitrogen Use Efficiency (%)	Nitrogen Content (%)	Protein Content (%)	Nitrogen Uptake (kg/ha)
	30 DAS	60 DAS	At harvest	60 DAS	At harvest									
Weed Management														
W_1	29.9	58.9	104.6	208.1	278.1	200.0	21.1	54.3	1638	3439	16.3	0.964	6.024	15.650
W_2	30.4	59.3	110.9	219.7	286.2	208.0	23.4	56.6	1779	3656	18.0	1.012	6.325	17.960
W_3	30.7	65.0	114.8	255.3	323.8	238.4	25.3	70.0	2032	4143	20.6	1.038	6.489	21.054
W_4	31.0	64.3	118.2	266.2	341.1	251.0	26.5	70.9	2283	4547	23.2	1.015	6.346	23.249
W_5	30.2	62.0	118.9	259.4	337.1	243.5	26.3	72.4	2354	4600	23.9	1.038	6.490	24.489
W_6	28.3	54.2	90.7	124.6	175.7	123.0	19.1	42.6	639	1986	6.60	0.990	6.188	6.334
S.Em ±	0.5	0.9	1.6	8.21	6.1	5.1	0.5	3.0	36.5	320.3	0.38	0.021	0.135	0.599
CD(P=0.05)	NS	2.6	4.5	23.0	17.2	14.3	1.3	9.4	102.3	1009.1	1.06	NS	NS	1.679
N Levels														
N_1	29.3	57.3	102.6	191.5	259.5	188.1	22.1	53.3	1605	3355	16.7	1.012	6.323	16.348
N_2	30.1	59.6	110.1	217.8	283.2	206.4	23.3	61.3	1759	3642	17.6	1.018	6.365	18.029
N_3	30.8	65.0	116.4	257.4	328.3	237.4	25.5	68.7	1999	4188	20.1	0.999	6.243	19.992
S.Em ±	0.40	0.70	1.10	5.60	7.70	3.40	0.30	1.20	25.70	72.30	0.24	0.016	0.100	0.435
CD	1.0	2.0	3.2	15.7	NS	9.5	0.9	3.4	72.0	202.9	0.74	NS	NS	1.221
W x N														
S.Em.±	2.50	1.59	2.66	13.70	18.90	8.30	0.80	2.90	61.90	176.90	0.64	0.03	0.23	0.99
CD	NS	NS	7.44	NS	NS	NS	NS	8.0	173.3	495.4	1.77	NS	NS	NS
CV %	11.20	8.60	7.70	18.50	13.10	11.90	10.00	14.80	10.57	13.89	10.64	11.39	11.39	17.27
Y x W														
S.Em ±	0.89	1.73	2.81	-	-	8.30	0.80	3.00	62.90	172.90	0.64			
CD	NS	NS	NS	-	-	NS	NS	NS	NS	NS	NS			
Y x N														
S.Em ±	0.63	1.23	1.98	-	-	5.80	0.60	2.10	44.50	122.30	0.45			
CD	NS	NS	NS	-	-	NS	NS	NS	NS	NS	NS			
Y x W x N														
S.Em ±	1.53	3.00	4.86	23.75	18.86	14.40	1.40	5.20	109.00	299.50	1.11	1.80		
CD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		

Table 3: Interaction effect of weed management and nitrogen levels on plant height (cm) at harvest, number of grains/panicle, grain yield (kg/ha), straw yield (kg/ha), nitrogen use efficiency (%) and dry weight of weed (g) /net plot at harvest of aerobic rice (pooled data)

Treatments	Plant Height (cm) at harvest			Number of Grains /Panicle			Grain Yield (kg/ha)			Straw Yield (kg/ha)			Nitrogen Use Efficiency (%)			Dry Weight of Weed (g)/Net Plot at harvest		
	N_1	N_2	N_3	N_1	N_2	N_3	N_1	N_2	N_3	N_1	N_2	N_3	N_1	N_2	N_3	N_1	N_2	N_3
W_1	92	108	114	41	55	67	1308	1563	2044	2764	3151	4492	17	16	16	50.033	57.667	54.188
W_2	107	110	116	49	55	66	1608	1769	1962	3148	3669	4151	16	18	20	54.722	47.267	62.588
W_3	113	112	119	59	72	79	1841	1920	2335	3700	3820	4908	19	19	23	38.222	49.633	40.555
W_4	110	118	126	68	71	73	2071	2335	2444	4431	4486	4725	20	23	26	42.033	40.211	44.122
W_5	115	116	125	62	73	82	2192	2259	2611	4340	4518	4940	22	23	27	36.677	42.288	41.011
W_6	78	95	98	40	42	45	609	709	599	1747	2208	2004	5	7	8	202.200	194.522	215.033
S.Em ±	2.6			3			62			177			0.63			4.157		
CD (P=0.05)	7.4			8			173			495			1.77			11.639		
CV %	7.7			14.8			10.6			13.9			10.6			17.93		

Table 4: Economics of different treatments

Sr. No.	Treatments	Grain Yield (kg/ha)	Straw Yield (kg/ha)	Total Cost (₹/ha)	Gross Realization (₹/ha)	Net Realization (₹/ha)	BCR
1	**W_1N_1**	1308	2764	17043	27323	10280	1.60
2	**W_1N_2**	1563	3151	17315	32200	14885	1.86
3	**W_1N_3**	2044	4402	17588	42947	25359	2.44
4	**W_2N_1**	1608	3147	18243	32838	14595	1.80
5	**W_2N_2**	1769	3669	18515	36741	18226	1.98
6	**W_2N_3**	1962	4151	18788	40993	22205	2.18
7	**W_3N_1**	1841	3700	21493	37885	16392	1.76
8	**W_3N_2**	1920	3821	21765	39394	17629	1.81
9	**W_3N_3**	2335	4908	22038	48695	26657	2.21
10	**W_4N_1**	2071	4431	22693	43422	20729	1.91
11	**W_4N_2**	2335	4486	22965	47431	24466	2.07
12	**W_4N_3**	2444	4725	23238	49734	26496	2.14
13	**W_5N_1**	2192	4340	22671	44911	22240	1.98
14	**W_5N_2**	2259	4519	22943	46426	23483	2.02
15	**W_5N_3**	2611	4940	23216	52807	29591	2.27
16	**W_6N_1**	609	1747	16263	14101	-2162	0.87
17	**W_6N_2**	709	2209	16535	16941	406	1.02
18	**W_6N_3**	599	2004	16808	14720	-2088	0.88

	Paddy grain	14.55 ₹/kg		Pretilaclor 50 % EC	₹ 520/ L
	Paddy straw	3.00 ₹/kg		Pendimethalin 30 EC	₹600/L
	Urea	6.27 ₹/kg		Bispyribac sodium salt 10% SC	₹ 445 / 50 ml
	SSP	7.00 ₹/kg			
	Am.sulphate	12.70 ₹/kg			

[MS received : September 11 , 2018] *[MS accepted : September 20, 2018]*