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Residual effect of integrated weed and nutrient management on the productivity and economics of zero tilled rapeseed in rice-rapeseed cropping sequence

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Abstract
A field experiment was conducted during the kharif and *rabi* season of 2016-17 and 2017-18 in the Research farm of College of Agriculture, Central Agricultural University, Imphal in order to study the residual effect of different weed and nutrient management on the productivity and economics of zero tilled rapeseed in rice-rapeseed cropping sequence. The experiment was laid out in factorial randomized block design (FRBD) replicated thrice. The pooled data revealed that among the weed management practices, application of Pyrazosulfuron ethyl (PSE) + Hand weeding (HW) at 40 DAS (W_2) and Pyrazosulfuron ethyl (PSE) + Mechanical weeding (MW) at 40 DAS (W_3) in preceding kharif rice gave the highest growth and yield of rapeseed. Among the nutrient management practices, better growth and yield of rapeseed were recorded with the application of 50% RDF+ 6t FYM (N_1) and 50% RDF+ Azolla (dual crop)@10t/ha + 3t FYM (N_2). Maximum gross returns, net returns and B:C ratio were also obtained with the above weed and nutrient management practices.

Keywords: Integrated weed management, integrated nutrient management, productivity, rapeseed and residual effect

Introduction

Rapeseed-mustard is the major Rabi oilseed crops of India. They occupy a prominent place being next in importance to groundnut both in area and production. Rapeseed-mustard contributes 28.6 % in the total oilseeds production among the seven edible oilseeds cultivated in India and ranks second after groundnut sharing 27.8% in the India’s oilseed economy. The annual production of rapeseed-mustard is about 8.17 mt covering an area of about 6.51 mha with a total productivity of 12.57 q ha^{-1} (GOI, 2O11) [5]. In Manipur after rice harvest, the land is kept fallow without any crop by most of the farmers which otherwise has huge potential for growing a second crop in the Rabi season with the residual moisture and additional one or two life saving irrigations. Rapeseed-Mustard is one of the most important choices to the farmers of Manipur which not only increase their income but also utilizes the residual moisture and nutrients present in soil. Season long weed management in kharif rice may also provide effective weed control for succeeding crop in winter seasons. The herbicides applied in preceding crop might show prolonged persistence in soil resulting in reduced weed infestation in succeeding crops in the system. However, sometimes undesirable herbicide residues may affect the growth and productivity of succeeding crop. Janki *et al.* (2015) [8] and Hernandez-Sevillano (2001) [7] reported that few sulfonylurea herbicide residues in soil can affect rotational crops even at low concentrations. But, farmers usually use herbicides without knowing or testing the residual effect of herbicides on the succeeding crops. Moreover, the existing system of fertilizer application is based on the nutrient requirement of the individual crop ignoring the carry over effect of the manure or fertilizer applied to the preceding crop. Organic sources of nutrients applied to preceding crop benefit the succeeding crop to a great extent (Hedge, 1998) [6]. Keeping the above points in mind, therefore, the experiment was conducted in order to study whether the integrated weed and nutrient management in preceding kharif rice has any residual effect on the productivity of the succeeding rapeseed crop.

Materials and Methods

The field experiment was conducted at the Research farm of College of Agriculture, Central Agricultural University, Imphal during the kharif and rabi season of 2016-17 and 2017-18. The soil of the experimental field was clayey in texture. The soil was medium in fertility with good drainage facility with 5.34 pH, high in organic carbon with 1.89%, 280.88 kg ha^{-1} available nitrogen, 32.20 kg ha^{-1} available P_2O_5 and 270 kg ha^{-1} available K_2O, respectively. The experiment was laid out in a factorial randomized block design (FRBD) in 3 replications. The treatments given in the preceding kharif rice comprised of 5 levels of weed management practices viz., Pyrazosulfuron ethyl @50g a.i ha^{-1} at 7 DAS (W_1), Pyrazosulfuron ethyl@30g a.i ha^{-1} at 7 DAS + 1 HW at 40 DAS (W_2), Pyrazosulfuron ethyl@30 g a.i ha^{-1} at 7 DAS + 1 MW at 40 DAS (W_3), Pyrazosulfuron ethyl@30g a.i ha^{-1} at 7 DAS + 2, 4-D @ 0.75kg a.i ha^{-1} at 40 DAS (W_4) and weedy check (W_5) and three levels of nutrient management practices i.e. 50% N from RDF + 6 t FYM (N_1), 50% N from RDF + Azolla (dual crop)@10 t/ha + 3t FYM (N_2) and 100% RDF (N_3). The rapeseed variety used in the experiment was M-27. The percent nutrient content of the FYM was 0.5 % N, 0.25% P_2O_5 and 0.5% K_2O respectively. The recommended dose of fertilizer for rapeseed was 40:30:20 kg N, P_2O_5 and K_2O per ha respectively. Half dose of nitrogen (N) and full dose of phosphorus (P_2O_5) and potassium (K_2O) were applied before sowing as basal application in the form of urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. The remaining half portion of nitrogen was applied at flower initiation stage. Rapeseed seeds were sown in lines with 20 cm row to row distance between the rows of stubbles left by previous rice crop with a plant to plant distance of 5 cm. The seed rate was 12 kg/ha and sowing was done in the last week of November. Two irrigations were given at the time of initial flowering stage and pod filling stage and one hand weeding was given at 25 DAS to control weeds. Growth parameters were recorded at 25 days interval and yield was recorded at the time of harvest. The data so obtained were subjected to statistical analysis by the analysis of variance method described by Panse and Sukhatme (1995) [12] and the significant of different sources of variations were tested by error mean square by Fisher and Snedecor's F test at probability level 0.05.

Results and Discussion

Residual effect of integrated weed and nutrient management on growth attributes of rapeseed

Different integrated weed and nutrient management practices given in preceding kharif rice had significant residual effect on the growth attributes of rapeseed as evident from the pooled data in Table 1. Among the different weed management practices, W_2 i.e. application of PSE@30g a.i at 7 DAS + 1 HW at 40 DAS resulted in maximum plant height (68.37 cm) and was found to be statistically higher than all the other treated plots. It was followed by the application of PSE@30g a.i at 7 DAS + 2, 4-D @ 0.75kg a.i at 40 DAS i.e. W_4 (66.01 cm) and W_3 i.e. application of PSE@30 g a.i at 7 DAS + 1 MW at 40 DAS (65.82 cm).

Similarly, highest number of branches per plant (4.41) was recorded with the application of PSE@30g a.i at 7 DAS + 1 HW at 40 DAS but no significant difference was found with W_3 i.e. application of PSE@30 g a.i at 7 DAS + 1 MW at 40 DAS (4.26) and W_4 i.e. the application of PSE@30g a.i at 7 DAS + 2, 4-D @ 0.75kg a.i at 40 DAS (4.16).

Maximum dry matter accumulation and crop growth rate were recorded with W_3 (302.17 g m^{-2} and 4.08 g m^{-2} day^{-1}) followed by W_2 (301.60 g m^{-2} and 3.63 g m^{-2} day^{-1}) but no significant difference was found between them for dry matter accumulation (Table 1). Application of PSEl@50g a.i at 7 DAS (W_1) recorded minimum growth attributes followed by the weedy check plot W_5.

From the results above, it can be concluded that application of Pyrazosulfuron ethyl and 2,4-D had no detrimental residual effect on the succeeding rapeseed crop. The differences in the growth attributes among the different weed management practices might be due to the variable extent of weed control in preceding kharif rice. Randhawa *et al.* (2007) [13] and Chakraborti *et al*. (2017) [2] also observed that pyrazosulfuron ethyl and 2, 4-D do not persist in soil and can have no adverse effect on the succeeding crop.

Among the nutrient management practices, highest growth attributes of rapeseed was recorded with the plots receiving a combination of inorganic fertilizers and organic sources of nutrients i.e. FYM and Azolla (Table 1). The application of 50% N from RDF + 6 t FYM (N_1) and 50% N from RDF + Azolla (dual crop)@10 t/ha + 3t FYM (N_2) recorded higher plant height (65.13 cm, 64.77 cm), number of branches per plant (4.26, 4.27), dry matter accumulation (276.60 g m^{-2}, 275.87 g m^{-2}) and crop growth rate (3.10 $gm^{-2}day^{-1}$, 3.19 $gm^{-2}day^{-1}$) but there was no statistical difference between them. Application of 100% RDF (N_3) in preceding kharif rice was found to have the least residual effect on the growth of rapeseed crop which is evident from the lowest growth attributes. The luxurious vegetative growth of the crop led to the increase in dry matter accumulation and ultimately the yield of rapeseed. This result also corroborates the findings of Pal *et al.* (2008) [11] and Jeyabal *et al*. (2000) [9] in mustard and sunflower.

The interaction between different weed and nutrient management practices given in kharif rice had no significant residual effect on the plant height, number of branches per plant and dry matter accumulation of succeeding rapeseed crop. However, the crop growth rate of rapeseed was significantly influenced by the interaction between different integrated weed and nutrient management practices given in preceding kharif rice crop (Table 3). The maximum crop growth rate was observed in the treatment combination W_3N_2 (4.53 g m^{-2} day^{-1}) which was statistically higher than the other remaining treatment combinations. The lowest crop growth was observed in the interaction between weedy check and application of 100% RDF i.e. W_5N_3. The mineralization of organic manures like FYM or solubilization of nutrients from native sources during the process of decomposition combined with better weed control might have resulted in the accumulation of more nutrient residues which was made available to the succeeding crop thus in turn giving better crop growth attributes of rapeseed.

Table 1: Residual effect of integrated weed and nutrient management on growth attributes of rapeseed.

Treatments	Plant height (cm)	Number of branches $plant^{-1}$	Dry matter accumulation ($g\ m^{-2}$)	Crop growth rate ($g\ m^{-2}\ day^{-1}$)
PSE@50 g a.i. ha^{-1} at 7 DAS (W_1)	62.78	4.08	282.27	3.32
PSE@30 g a.i. ha^{-1} at 7 DAS + 1 HW at 40 DAS (W_2)	68.37	4.41	301.60	3.63
PSE@30 g a.i. ha^{-1} at 7 DAS + 1 MW at 40 DAS (W_3)	65.82	4.26	302.17	4.08
PSE@30 g a.i. ha^{-1} at 7 DAS + 2,4-D@0.75 kg a.i. ha^{-1} at 40 DAS (W_4)	66.01	4.16	291.42	3.57
Weedy check (W_5)	54.70	3.70	173.84	0.66
SEm (±)	0.54	0.10	2.10	0.09
CD (p=0.05)	1.57	0.29	6.09	0.25
50% N from RDF + 6 t FYM (N_1)	65.13	4.26	276.60	3.10
50% N from RDF+ Azolla (dual crop)@10t ha^{-1} + 3t FYM (N_2)	64.77	4.27	275.87	3.19
100% RDF (N_3)	60.71	3.85	258.31	2.87
SEm (±)	0.42	0.08	1.63	0.07
CD (p=0.05)	1.22	0.22	4.71	0.19

PSE: Pyrazosulfuron ethyl; DAS: Days after sowing; HW: Hand weeding; MW: Mechanical weeding; RDF: Recommended dose of fertilizer

Residual effects of integrated weed and nutrient management on yield attributes and yield of rapeseed at harvest

Yield attributes

Different integrated weed and nutrient management practices showed significant residual effect on the number of siliqua per plant of succeeding rapeseed crop (Table 2). The pooled data revealed that application of PSE@30 g a.i at 7 DAS + 1 MW at 40 DAS (W_3) and PSE@30g a.i at 7 DAS + 2, 4-D @ 0.75kg a.i at 40 DAS (W_4) recorded maximum number of siliqua per (57.30) which was comparable with the plot receiving PE @50g a.i at 7 DAS (W_1) and PE@30g a.i at 7 DAS + 1 HW at 40 DAS (W_2) with the value of 56.55 and 55.09 respectively but they were significantly higher than the weedy check plot, W_5 (33.60). Similarly maximum number of seeds per siliqua (17.09) was observed in the plot receiving PSE@30 g a.i at 7 DAS + 1 MW at 40 DAS (W_3) which was statistically comparable with the treatment PSE@30g a.i at 7 DAS + 1 HW at 40 DAS (W_2) with 16.88 number of seeds per siliqua. It was followed by W_4 (16.17) and W_1 (15.47). Lowest number of seeds per siliqua was recorded with the weedy check plot W_5 (13.83).

It is revealed from the pooled data in Table 2 that out of the three nutrient management practices, statistically highest number of siliqua per plant and number of seeds per siliqua (57.93, 16.38) was observed in the plot receiving 50% N from RDF + 6 t FYM (N_1) and N_2 i.e. 50% N from RDF + Azolla (dual crop)@10 t/ha + 3t FYM (51.88, 16.34) and least residual effect was observed in N_3 i.e. 100% RDF (46.10, 14.94). Satyajeet *et al*. (2007) [16] studied the residual effect on the Indian mustard (cv. RH-30) crop after pearl millet where the application of vermicompost and biofertilizer to the previous pearl millet crop improved the yield characteristics of the succeeding Indian mustard. Similar result was also observed by De and Sinha (2012) [3] and Devi *et al*. 2015 [4] in succeeding crop.

The interaction between different weed and nutrient management practices showed significant residual effect on the number of siliqua per plant and number of seeds per siliqua of rapeseed (Table 3). Application of PSE@30 g a.i at 7 DAS + 1 MW at 40 DAS with 50% N from RDF + 6 t FYM (W_3N_1) recorded significantly highest number of siliqua per plant (70.07) which was followed by the treatment combinations W_1N_1 (62.90), W_4N_1 (62.34), W_2N_1 (61.11) and W_4N_2 (59.85), respectively but with no significant difference among these four treatment combinations. The maximum number of seeds per siliqua (17.99) was recorded in the interaction W_3N_2 but it was statistically at par with the treatment combination W_2N_1 (17.70). The minimum number of siliqua per plant and seeds per siliqua was recorded with the treatment combinations which include the weedy check i.e. W_5N_1 (33.23, 14.00), W_5N_2 (31.85, 13.99) and W_5N_3 (35.73, 13.48) but they were significantly at par with each other.

Yield

It is evident from Table 2 that the various integrated weed and nutrient management practices given in preceding kharif rice had significant residual effect on the yield of succeeding rapeseed crop. Higher seed and stover yield was obtained in the plot receiving W_2 i.e. PSE@30g a.i at 7 DAS + 1 HW at 40 DAS (988.60 kg ha^{-1} and 2027.40 kg ha^{-1}) and W_3 i.e. PSE@30g a.i at 7 DAS + 1 MW at 40 DAS (988.03 kg ha^{-1} and 2033.65 kg ha^{-1}) and they were significantly at par with each other. The plots receiving PSE@30g a.i at 7 DAS + 2, 4-D @0.75kg a.i at 40 DAS (W_4) and PSE @50g a.i at 7 DAS (W_1) gave significantly lower seed and stover yield among the treated plots. The lowest seed and stover yield was recorded with the weedy check plot, W_5 (592.33 kg ha^{-1} and 1271.62 kg ha^{-1}). It is therefore evident from the above results that the herbicides applied in preceding rice had no harmful residual effect on the growth and yield of succeeding rapeseed crop. Similar findings were also recorded by Bijarnia *et al*., 2017 [1] and Sharma *et al*., 2014 [17]. The lowest value of yield in the unweeded control plot may be due to severe competition by weeds for nutrients in the preceding rice which in turn have reduced the availability of nutrients to the succeeding crop and as a result growth and yield were adversely affected.

Among the different integrated nutrient management practices, the highest seed and stover yield were observed in the plot receiving N_1 i.e. application of 50% N from RDF + 6 t FYM (911.53 kg ha^{-1} and 1873.89 kg ha^{-1}) which was followed by N_2 i.e. application of 50% N from RDF + Azolla (dual crop)@10 t/ha + 3t FYM (905.24 kg ha^{-1} and 1871.77 kg ha^{-1}) but with no statistical difference between them. Application of 100% RDF (N_3) had the least residual effect and gave the lowest seed and stover yield of 837.53 kg ha^{-1} and 1783.80 kg ha^{-1}, respectively (Table 2)

The interaction between the various integrated weed and nutrient management practices had significant residual effect on the seed yield of succeeding rapeseed crop (Table 3). Among the different treatment combinations, the interaction between PE@30 g a.i at 7 DAS + 1 MW at 40 DAS and 50% N from RDF + 6 t FYM (W_3N_1) recorded the maximum seed yield of 1031.46 kg ha^{-1} but it was statistically comparable with the treatment combinations W_2N_1 (1018.00 kg ha^{-1}) and W_3N_2 (1017.58 kg ha^{-1}). The lowest yield was recorded with the interaction between the weedy check and 100% RDF (W_5N_3) with a yield of 561.50 kg ha^{-1}.

Oil yield

It is evident from Table 2 that different integrated weed and nutrient management practices had significant residual effect on the oil yield of succeeding rapeseed crop. The pooled data revealed that among the different weed management practices, application of PSE@30g a.i at 7 DAS + 1 HW at 40 DAS (W_2) and PSE@30g a.i at 7 DAS + 1 MW at 40 DAS (W_3) recorded significantly comparable oil yield of 347.69 kg ha^{-1} and 347.39 kg ha^{-1}, respectively but were found to be significantly higher than the treatments W_4 (329.24 kg ha^{-1}) and W_1 (319.76 kg ha^{-1}). The weedy check plot W_5 gave the lowest oil yield of 207.86 kg ha^{-1}.

Among the three nutrient management practices, N_2 i.e. application of 50% N from RDF + Azolla (dual crop)@10 t/ha + 3t FYM recorded the maximum oil yield of 324.35 kg ha^{-1} which was significantly higher than N_1 i.e. application of 50% N from RDF + 6 t FYM (307.30 kg ha^{-1}) and N_3 i.e. 100% RDF (300.49 kg ha^{-1}), respectively (Table 2). The essential elements like secondary and micronutrient contained in FYM and Azolla probably promoted the synthesis of oils. In addition to supplying micronutrients, FYM also increases fertilizer use efficiency and make the phosphate in the soil more available to plants even in slightly acidic soil. All these reasons reflected positively in improving yield and ultimately oil yield in rapeseed. The lowest oil yield was observed with 100% RDF. Singh *et al*. (2012) [18] and Mookherjee *et al*. (2014) [10] also observed similar results.

Table 2: Residual effect of integrated weed and nutrient management on the yield attributes and yield of rapeseed at harvest.

Treatments	Number of siliqua plant^{-1}	Number of seeds siliqua^{-1}	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Oil yield (kg ha$^{=1}$)
PSE@50 g a.i. ha^{-1} at 7 DAS (W_1)	56.55	15.47	913.86	1908.84	319.76
PSE@30 g a.i. ha^{-1} at 7 DAS + 1 HW at 40 DAS (W_2)	55.09	16.88	988.60	2027.40	347.69
PSE@30 g a.i. ha^{-1} at 7 DAS + 1 MW at 40 DAS (W_3)	57.30	17.09	988.03	2033.65	347.39
PSE@30 g a.i. ha^{-1} at 7 DAS + 2,4-D@0.75 kg a.i. ha^{-1} at 40 DAS (W_4)	57.30	16.17	941.02	1974.25	329.24
Weedy check (W_5)	33.60	13.83	592.33	1271.62	209.49
SEm (±)	0.87	0.13	3.73	17.39	1.38
CD (p=0.05)	2.52	0.37	10.79	50.38	4.01
50% N from RDF + 6 t FYM (N_1)	57.93	16.38	911.53	1873.89	307.30
50% N from RDF+ Azolla (dual crop)@10t ha^{-1} + 3t FYM (N_2)	51.88	16.34	905.24	1871.77	324.35
100% RDF (N_3)	46.10	14.94	837.53	1783.80	300.49
SEm (±)	0.67	0.10	2.89	13.47	1.07
CD (p=0.05)	1.95	0.29	8.36	39.03	3.10

PSE: Pyrazosulfuron ethyl; DAS: Days after sowing; HW: Hand weeding; MW: Mechanical weeding; RDF: Recommended dose of fertilizer

The interaction between different weed and nutrient management practices had significant residual effect on the oil yield of succeeding rapeseed crop (Table 3). Significantly highest oil yield was recorded with the interaction between PSE@30 g a.i at 7 DAS + 1 MW at 40 DAS and 50% N from RDF + Azolla (dual crop)@10 t/ha + 3t FYM (W_3N_2) with a value of 365.64 kg ha^{-1}. It was closely followed by the treatment combination W_2N_2 (358.55 kg ha^{-1}). The lowest oil yield was obtained in the plot W_5N_1 with no weed control and receiving 50% N from RDF + 6t FYM (203.03 kg ha^{-1}) closely followed by W_5N_3 i.e. the interaction between weedy check and 100% RDF (203.07 kg ha^{-1}) but there was no significant difference between them. Excellent control of dominant weeds without any adverse residual effect on crop growth with adequate supply of nutrients through combined application of inorganic fertilizers and manure favored higher seed yield of rapeseed.

Table 3: Residual effect of interaction between integrated weed and nutrient management on the growth and yield of rapeseed.

Treatments	Crop growth rate (g m^{-2} day^{-1})	Number of siliqua plant^{-1}	Number of seeds siliqua^{-1}	Seed yield (kg ha^{-1})	Oil yield (kg ha$^{=1}$)
W_1N_1	3.37	62.90	15.98	939.42	315.01
W_1N_2	3.47	55.83	16.00	930.25	333.03
W_1N_3	3.12	50.93	14.44	871.92	311.24
W_2N_1	3.66	61.11	17.70	1018.00	343.40
W_2N_2	3.64	57.39	17.19	1001.54	358.55
W_2N_3	3.58	46.78	15.73	946.26	341.10
W_3N_1	3.83	70.07	17.28	1031.46	348.29
W_3N_2	4.53	54.46	17.99	1017.58	365.64
W_3N_3	3.89	47.38	16.01	915.07	328.25
W_4N_1	3.88	62.34	16.95	974.45	326.77
W_4N_2	3.38	59.85	16.52	955.70	342.15
W_4N_3	3.46	49.70	15.04	892.91	318.79
W_5N_1	0.75	33.23	14.00	594.34	203.03
W_5N_2	0.92	31.85	13.99	621.15	222.38
W_5N_3	0.31	35.73	13.48	561.50	203.07
SEm (±)	0.15	1.50	0.22	6.45	2.40
CD (p=0.05)	0.43	4.36	0.65	18.70	6.94

Residual effect of integrated weed and management on economics of rapeseed

The pooled data in Table 4 revealed that the application of PSE@30g a.i at 7 DAS + 1 MW at 40 DAS with 50% N from RDF + 6 t FYM (W_3N_1) gave the highest gross returns, net returns and B:C ratio of Rs. 51,573, Rs. 29,968 and 1.39, respectively followed by the treatment combination W_2N_1 (Rs. 50,900, Rs. 29,295 and 1.36) and W_3N_2 (Rs. 50,879, Rs. 29,274 and 1.35). The plot with no weed control receiving 100% RDF (W_5N_3) gave the lowest gross returns (Rs.

28,075), net returns (Rs. 6,470) and B:C ratio of 0.30. The production of additional yield along with higher market price of rapeseed seeds may have attributed to higher net returns and B:C ratio. These results are in conformity with the results obtained by Saravanane and Chellamuthu (2015) [15] and Ravathi and Annadural (2014) [14].

Table 4: Residual effect of integrated weed and nutrient management on the economics of rapeseed.

Treatments	Cost of cultivation (Rs ha^{-1})	Gross returns (Rs ha^{-1})	Net returns (Rs ha^{-1})	B:C ratio
W_1N_1	21605	46971	25366	1.17
W_1N_2	21605	46513	24908	1.15
W_1N_3	21605	43596	21991	1.02
W_2N_1	21605	50900	29295	1.36
W_2N_2	21605	50077	28472	1.32
W_2N_3	21605	47313	25708	1.19
W_3N_1	21605	51573	29968	1.39
W_3N_2	21605	50879	29274	1.35
W_3N_3	21605	45754	24149	1.12
W_4N_1	21605	48723	27118	1.26
W_4N_2	21605	47785	26180	1.21
W_4N_3	21605	44646	23041	1.07
W_5N_1	21605	29717	8112	0.38
W_5N_2	21605	31057	9452	0.44
W_5N_3	21605	28075	6470	0.30

W_1: PSE @50g a.i at 7 DAS
W_2: PSE@30g a.i at 7 DAS + 1 HW at 40 DAS
W_3: PSE@30 g a.i at 7 DAS + 1 MW at 40 DAS
W_4: PSE@30g a.i at 7 DAS + 2, 4-D @ 0.75kg a.i at 40 DAS
W_5: Control
N_1: 50% N from RDF + 6 t FYM
N_2: 50% N from RDF + Azolla (dual crop)@10 t/ha + 3t FYM
N_3: 100% RDF

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