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Effect of integrated weed and nutrient management in greengram-rice-onion cropping sequence on yield and nitrogen balance sheet

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ABSTRACT

Field experiment was undertaken during 2010-2012 to evaluate the nutrient recycling and production potential of rice based cropping sequences. After kharif (rainy) rice, onion and greengram were grown during rabi (winter) and pre-kharif (pre-monsoon) season, respectively. The biomass of weeds were composted and incorporated into the soil. Significantly maximum system pooled yield (24.395t ha^{-1}) was recorded in the treatment Parthenium and Calotropis leaf extract @ 5 % v/v at 1 DAS / DAT + HW at 21 DAS / DAT (W_2) and it was statistically at par with farmer practice (23.780t ha^{-1}). The system yield of the plots receiving W_2 treatments were recorded 17.57 % higher than farmer practice. The maximum system yield was (25.679 t ha^{-1} pooled data) registered under 40 % recommended N + 20 % N through neemcake + 40 % N through weed compost + full PK (N_6) which was found statistically at par with 50 % recommended N + 20 % N through neemcake + 30% N through weed compost + full PK (N_5). The percentage increase in system yield in the plots receiving N_6 and N_5 was 25.00 % and 22.47%, respectively higher over that receiving 100 % recommended NPK (N_1). Nitrogen balance was positive under all treatments of weed management ranging from 90.15 to 195.44kg ha^{-1} after completion of two cropping cycles. Only negative balance was recorded in case of N_1 (-123.28kg ha^{-1}). Maximum N balance was recorded in case of N_6 (+335.20) which was followed by N_5 (+253.26 kg ha^{-1}), N_4 (+198.40kg ha^{-1}) and N_3 (+132.45kg ha^{-1}).

Keywords: Nitrogen balance sheet, nutrient recycling, rice based cropping sequence and weed biomass

Rice based cropping sequence is the most dominant crop sequence in India as well as in West Bengal. Continuous cultivation of rice for a longe period with low system productivity and often with poor crop management practices, results in loss of soil fertility due to emergence of multiple nutrient deficiency and deterioration of soil physical properties, and decline in factor productivity and crop yields in high productivity areas (Yadav and Chauhan, 1998). During cultivation of rice, soil undergoes drastic changes, *i.e.*, aerobic to anaerobic environment, leading to several physical and electro-chemical transformations. If this is the case, then perhaps there is an important role for crop diversification that includes upland crops, such as legumes, to induce sequestration of N.

Every year with every crop, we used to waste huge amount of on-farm weed biomass. Weed biomass associated with crops contain a good amount of essential nutrients, are either removed from field or burnt in the field. Effective management of weed biomass can have a beneficial effect on soil fertility through the addition of organic matter and plant nutrients, and improvement in soil condition (Munda *et al.*, 2006, Singh 2003, Sidhu and Beri 1989, Srivastava *et al.*, 1988). Various composts have been used as a means to improve soil fertility. The supplementary or complementary use of these on-farm weed biomass besides improving soil physical, chemical and biological properties, also improve fertilizer use efficiency. There is scope to work on supplementation of organic fertilizers through locally available organic sources (weed biomass) to get desired sustainable results.

The growing urgent need for sustainable agriculture has led to a renewed interest in recycling of nutrients through organic sources in restoring soil fertility and sustaining crop productivity. Weed menace is likely to increase in near future. Among different factors, weed plays most important role for the reduction of crop yield. To convert the defect into effect, on-field weed biomass can be used in the crop field for nutrient recycling as well as weed management. Considering good nutrient recycling through weed compost, irrigation facilities, fertile soil of the area, greengram being a good source of quality protein, good demand of onion (vegetable) in the market, and rice as staple food crop of this region, the present research work entitled "Effect of Integrated Weed and Nutrient Management in Greengram-Rice-Onion Cropping Sequence" with the following objectives:

- To find out the effect of different weed and nutrient management and their influence on system yield of greengram-rice-onion cropping sequence.
- To find out the nitrogen balance sheet.

MATERIALS AND METHODS

The field experiment was conducted in humid sub-tropics of West Bengal at the Kalyani C-Block Farm (latitude: $23^0 59'14''$ N, longitude: 88027′16″E and altitude of 9.75m above msl) of Bidhan Chandra Krishi Viswavidyalaya, Kalyani,

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Nadia during two consecutive years from March, 2010 to March, 2012. Each plot size was of 20m^2. The experimental soil was well drained, alluvial in nature and sandy loam in texture (Sand 56.8%, silt 23.4%, clay 19.76%), having pH 6.86, organic carbon 0.569%, total nitrogen 0.0582%, available phosphorus 31.27kg ha^{-1} and available potassium 239.87kg ha^{-1}, respectively were estimated by combined glass electrode pH meter method, Walkley and Black's rapid titration method, Modified macro Kjeldahl method, Olsen's method and Flame photometer method, respectively (Jackson, 1973).

The experiment was conducted with three main plot treatments and six sub-plot treatments replicated thrice with split plot design. The cropping sequence was greengram ($_{CV.}$ Bireswar) -rice ($_{CV.}$ Shatabdi) - onion ($_{CV.}$ Sukhsagar). Three main plot treatments were: W_1-farmer practice (HW at 21 days after sowing (DAS) / days after transplanting (DAT)); W_2- Spraying of *Parthenium* and *Calotropis* leaf extract @ 5 % v/v at 1 DAS / DAT + HW at 21 DAS / DAT; W_3-quizalofop-ethyl 5 % EC @ 50 g ha^{-1} at 30 DAS (greengram), pretilachlor 37.5 % EC @ 500 g ha^{-1} (rice) 3 DAT, oxyfluorfen 23.5 % EC @ 100 g ha^{-1} (onion) at 4 DAT. General wheel hoe at 15 DAS / DAT for greengram and onion and paddy weeder was applied at 15 DAT in rice for all the weed management practices. Six sub plot treatments were: N_1-100 % recommended NPK (Inorganic fertilizer); N_2- 80 % recommended N +20 % N through neemcake + full PK; N_3- 70% recommended N +20 % N through neemcake +10 % N through weed compost + full PK; N_4- 60 % recommended N + 20 % N through neemcake + 20 % N through weed compost + full PK; N_5- 50 % recommended N + 20 % N through neemcake + 30 % N through weed compost + full PK; N_6- 40 % recommended N + 20 % N through neemcake + 40 % N through weed compost + full PK.

Rice equivalence of the system was determined by dividing total price of we produce to be compared with price of rice kg^{-1}.

$$\text{Rice equivalent yield} = \frac{\text{Economic yield} \times \text{price of the produce kg}^{-1}}{\text{Price of rice kg}^{-1}} \times 100$$

Balance sheet of nutrients in soil was determined by using the formula as suggested by Raghuwanshi *et al.* (1991). B = Y-(X-A)-N Where B = Balance sheet of nutrient, Y= Uptake of nutrient by crop, X= Initial nutrient status of the soil, A= Final nutrient status of soil, N= Nutrient added through fertilizer and manures.

Data obtained from the 2 years were pooled and statistically analyzed using the F test as per the procedure given by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Effect of weed management

Changes in weed management practices had a significant effect in changing the system yield based on REY, the maximum system yield (24.395 t ha^{-1} pooled data) was recorded in the treatment W_2 where component crops were treated with spraying of *Parthenium* + *Calotropis* leaf extract @ 5 % v/v at 1 DAS / DAT + HW at 21 DAS / DAT and it was statistically at par with W_3 (23.780 t ha^{-1} pooled data). The rice equivalent yield of the plots receiving W_2 treatments were recorded to be 17.57% higher than W_1 (Table 1).

The reason might be due to lesser crop weed competition through better weed management. As a result, greater availability of nutrients, sunlight, space and water to the crops. This is in agreement with the findings of Gaikwad *et al.* (2009) and Mandal *et al.* (2002).

Effect of nutrient management practices

From the pooled analysis it was found that the system yield differed significantly with the different nutrient management practices (Table 1). The system yield of the green gram-rice-onion cropping system increased with increasing levels of weed compost. The maximum system yield (pooled) was (25.679tha^{-1}) registered under N_6 (40 % recommended N + 20 % N through neem cake + 40 % N through weed compost + full PK). The system yield was found statistically *at par* with N_5 (50 % recommended N + 20 % N through neem cake + 30 % N through weed compost + full PK). N_1 (100% recommended NPK) recorded the least system yield of 20.543 t ha^{-1} (pooled data). The percentage increase in system yield in the plots receiving N_6 and N_5 was higher (25.00 and 22.47%, respectively) over that receiving N_1.

This might be due to better soil physical and chemical environments developments with the application of weed compost and neemcake which helped to enhance the availability and absorption of macro and micronutrients thereby increased the yield of the crops. This is corroborated with the findings of several workers such as Acharya and Mondal (2010), Bedi and Dubey (2009), Das *et al.* (2009).

Table 1: Effect of integrated weed and nutrient management on rice equivalent yield of component crops of green gram-rice-onion cropping sequence and system yield

Treatments	Rice equivalent yield of green gram (t ha^{-1})			Yield of rice (t ha^{-1})			Rice equivalent yield of onion (t ha^{-1})			System yield (t ha^{-1})		
	2010-11	**2011-12**	**Pooled**	**2010-11**	**2011-12**	**Pooled**	**2010-11**	**2011-12**	**Pooled**	**2010-11**	**2011-12**	**Pooled**
W_1	3.12	3.53	3.33	3.42	3.58	3.50	13.45	14.40	13.92	19.99	21.51	20.75
W_2	3.67	4.15	3.91	4.40	4.58	4.49	15.47	16.52	16.00	23.54	25.25	24.40
W_3	3.62	4.12	3.87	3.93	4.13	4.03	15.35	16.42	15.88	22.90	24.66	23.78
SEm (±)	**0.05**	**0.05**	**0.04**	**0.10**	**0.10**	**0.09**	**0.24**	**0.25**	**0.21**	**0.42**	**0.44**	**0.38**
LSD (0.05)	**0.18**	**0.19**	**0.12**	**0.40**	**0.41**	**0.30**	**0.92**	**0.98**	**0.70**	**1.66**	**1.72**	**1.24**
CV%	**5.68**	**5.22**	**6.08**	**11.11**	**10.83**	**13.67**	**6.86**	**6.79**	**8.53**	**8.20**	**7.91**	**10.07**
N_1	3.20	3.64	3.42	3.50	3.69	3.60	13.11	13.95	13.53	19.82	21.27	20.54
N_2	3.25	3.69	3.47	3.52	3.73	3.63	13.47	14.26	13.87	20.24	21.68	20.96
N_3	3.34	3.76	3.55	3.79	3.96	3.87	14.37	15.25	14.81	21.49	22.96	22.23
N_4	3.53	3.98	3.76	4.00	4.15	4.07	14.82	16.08	15.45	22.34	24.21	23.28
N_5	3.72	4.21	3.97	4.26	4.46	4.36	16.29	17.38	16.83	24.27	26.05	25.16
N_6	3.79	4.31	4.05	4.44	4.59	4.51	16.48	17.76	17.12	24.71	26.65	25.68
SEm (±)	**0.05**	**0.05**	**0.04**	**0.11**	**0.11**	**0.10**	**0.25**	**0.29**	**0.23**	**0.45**	**0.49**	**0.40**
LSD (0.05)	**0.14**	**0.14**	**0.11**	**0.31**	**0.31**	**0.27**	**0.72**	**0.84**	**0.66**	**1.29**	**1.42**	**1.12**
CV%	**4.11**	**3.76**	**4.47**	**8.16**	**7.89**	**10.11**	**5.11**	**5.65**	**6.58**	**6.13**	**6.28**	**7.37**
W_1N_1	2.78	3.14	2.96	3.01	3.18	3.09	12.18	13.09	12.63	17.97	19.41	18.69
W_1N_2	2.87	3.25	3.06	3.04	3.27	3.15	13.38	14.36	13.87	19.29	20.88	20.08
W_1N_3	2.90	3.31	3.11	3.21	3.34	3.28	13.48	14.27	13.88	19.59	20.92	20.26
W_1N_4	3.22	3.63	3.43	3.48	3.56	3.52	13.52	14.38	13.95	20.23	21.58	20.90
W_1N_5	3.46	3.90	3.68	3.81	3.99	3.90	13.87	14.59	14.23	21.13	22.47	21.80
W_1N_6	3.48	3.97	3.72	3.96	4.15	4.05	14.27	15.69	14.98	21.71	23.80	22.76
W_2N_1	3.38	3.84	3.61	3.94	4.13	4.03	12.77	13.64	13.21	20.09	21.61	20.85
W_2N_2	3.42	3.87	3.64	4.04	4.25	4.15	13.20	13.86	13.53	20.66	21.98	21.32
W_2N_3	3.57	3.95	3.76	4.32	4.46	4.39	15.45	16.53	15.99	23.34	24.94	24.14
W_2N_4	3.66	4.15	3.90	4.56	4.77	4.67	15.99	17.53	16.76	24.21	26.45	25.33
W_2N_5	3.96	4.48	4.22	4.66	4.88	4.77	17.60	18.79	18.19	26.22	28.14	27.18
W_2N_6	4.05	4.61	4.33	4.91	4.97	4.94	17.78	18.80	18.29	26.74	28.38	27.56
W_3N_1	3.44	3.92	3.68	3.57	3.77	3.67	14.38	15.11	14.74	21.39	22.80	22.09
W_3N_2	3.46	3.97	3.72	3.47	3.68	3.57	13.84	14.54	14.19	20.78	22.18	21.48
W_3N_3	3.55	4.02	3.78	3.83	4.08	3.95	14.17	14.95	14.56	21.54	23.04	22.29
W_3N_4	3.70	4.17	3.94	3.94	4.10	4.02	14.94	16.34	15.64	22.59	24.61	23.60
W_3N_5	3.75	4.26	4.01	4.31	4.50	4.41	17.39	18.78	18.09	25.45	27.54	26.50
W_3N_6	3.84	4.35	4.09	4.44	4.64	4.54	17.39	18.79	18.09	25.67	27.77	26.72
W_1N_1	2.78	3.14	2.96	3.01	3.18	3.09	12.18	13.09	12.63	17.97	19.41	18.69
W_1N_2	2.87	3.25	3.06	3.04	3.27	3.15	13.38	14.36	13.87	19.29	20.88	20.08
W_1N_3	2.90	3.31	3.11	3.21	3.34	3.28	13.48	14.27	13.88	19.59	20.92	20.26
W_1N_4	3.22	3.63	3.43	3.48	3.56	3.52	13.52	14.38	13.95	20.23	21.58	20.90
W_1N_5	3.46	3.90	3.68	3.81	3.99	3.90	13.87	14.59	14.23	21.13	22.47	21.80
W_1N_6	3.48	3.97	3.72	3.96	4.15	4.05	14.27	15.69	14.98	21.71	23.80	22.76
W_2N_1	3.38	3.84	3.61	3.94	4.13	4.03	12.77	13.64	13.21	20.09	21.61	20.85
W_2N_2	3.42	3.87	3.64	4.04	4.25	4.15	13.20	13.86	13.53	20.66	21.98	21.32
W_2N_3	3.57	3.95	3.76	4.32	4.46	4.39	15.45	16.53	15.99	23.34	24.94	24.14
SEm (±) W×N	**0.08**	**0.09**	**0.07**	**0.18**	**0.19**	**0.16**	**0.43**	**0.51**	**0.40**	**0.78**	**0.85**	**0.68**
SEm (±) N×W	**0.07**	**0.07**	**0.06**	**0.15**	**0.17**	**0.15**	**0.37**	**0.43**	**0.37**	**0.68**	**0.68**	**0.59**
LSD (0.05) W×N	**0.24**	**0.25**	**0.19**	**0.53**	**0.54**	**0.47**	**1.24**	**1.46**	**1.14**	**2.24**	**2.46**	**1.94**
LSD (0.05) N×W	**0.22**	**0.25**	**0.18**	**0.47**	**0.52**	**0.50**	**1.15**	**1.43**	**1.14**	**2.10**	**2.17**	**1.92**
CV%	**4.11**	**3.76**	**4.47**	**8.16**	**7.89**	**10.11**	**5.11**	**5.65**	**6.58**	**6.13**	**6.28**	**7.37**

Note:W_1-farmer practice (HW at 21 DAS / DAT); W_2- Spraying of Parthenium and Calotropis leaf extract @ 5 % v/v at 1 DAS / DAT + HW at 21 DAS / DAT; W_3-quizalofop-ethyl 5 % EC @ 50 g ha^{-1} at 30 DAS (greengram), pretilachlor 37.5 % EC @ 500 g ha^{-1} (rice) 3 DAT, oxyfluorfen 23.5 % EC @ 100 g ha^{-1} (onion) at 4 DAT. N_1-100 % recommended NPK (Inorganic fertilizer); N_2- 80 % recommended N +20 % N through neemcake + full PK; N_3- 70% recommended N +20 % N through neemcake +10 % N through weed compost + full PK; N_4- 60 % recommended N + 20 % N through neemcake + 20 % N through weed compost + full PK; N_5- 50 % recommended N + 20 % N through neemcake + 30 % N through weed compost + full PK; N_6- 40 % recommended N + 20 % N through neemcake + 40 % N through weed compost + full PK.

Interaction effect of weed and nutrient management treatments

The system yield varied significantly with the interaction between weed and nutrient management practices (Table 1). The system yield increased maximum in W_2N_6 which was 47.46 % higher over the plots receiving 100% NPK through fertilizer combined with farmer practice of weed management (W_1N_1). W_2N_6 was closely followed by W_2N_5 (45.43%), W_3N_6 (42.96%) and W_3N_5 (41.76%). W_2N_6 W_2N_5 W_3N_6 and W_3N_5 were statistically *at par* among themselves. The increase in yield may be due to lesser competition from weeds along with the fact that well decomposed organic manure in conjugation with mineral fertilizer not only provided additional nutrients other than N, P and K but also improved physico-chemical and biological properties of the soil.

Nitrogen balance sheet under different weed and nutrient management

Nitrogen is one of the important macronutrients required in the greatest amount by plants and is also the most mobile in the soil environment. The availability of N and its uptake and utilization by crops are therefore closely related to productivity, but are controlled by numerous abiotic and biotic factors in the soil-plant system, including cultivar, fertilizer input, weather, pests, and management of soil, crop residue, irrigation, and drainage (Singh *et al*., 2005; Witt *et al.*, 2000; Dobermann and White, 1999).

Effect of weed management

Nitrogen balance was positive under all treatments of weed management ranging from 90.15 to 195.44 kg ha^{-1} after completion of two cropping cycles (Table 2). The initial and final total soil N data revealed that, after 2 years of cropping, there was a highly significant difference in N in the topsoil despite of same initial total N value and amount of nitrogen added. W_2 where spraying of *Parthenium* + *Calotropis* leaf extract @5 % v/v at 1 DAS / DAT + HW at 21 DAS / DAT (+195.44 kg ha^{-1}) were applied recorded remarkably highest N balance followed by W_3 [(quizalofop-ethyl 5% EC at 30 DAS (greengram), pretilachlor 37.5% EC (rice) at 3 DAT, oxyfluorfen 23.5% (onion) at 4 DAT)](+140.23kg ha^{-1}). Least N balance (+90.15 kg ha^{-1}) was observed in case of W_1 (farmer practice HW at 21 DAS / DAT). These variations might be due to the higher efficiency of this treatment in suppressing the weeds, which ultimately resulted in reduced competition from weeds for nutrients. Uptake of nutrients by the crop was inversely proportional to the uptake of nutrients by weeds. The results are in conformity with the findings of Kori *et al*. (1997).

Effect of nutrient management

Positive nitrogen balance was recorded under all treatments except for N_1 where 100% recommended NPK was applied through fertilizers (Table 2). The initial and amount of N added were same for all the nutrient management treatments. But after 2 years of cropping, there was a significant decrease in N in the topsoil of N_1. Only negative balance was recorded in case of N_1 (-123.28 kg ha^{-1}). The decrease in soil N suggests that there were substantial losses of N (e.g. by volatilization, denitrification, leaching or runoff). It is evident that depletion of 20% inorganic N with neemcake recorded significant increment of N balance in N_2 (+178.28 kg ha^{-1}) over N_1. With increasing rates of weed compost positive N balance also increased. Maximum N balance (+335.20kg ha^{-1}) was recorded in case of N_6 (40 % recommended N + 20 % N through neemcake + 40 % N through weed compost + full PK) which was followed by N_5 (+253.26 kg ha^{-1}), N_4 (+198.40kg ha^{-1}) and N_3 (+132.45kg ha^{-1}), respectively. The positive nitrogen balance was observed where the crop was supplied with organic manure in conjunction with inorganic fertilizer. Even when the crop received full recommended dose of N, P and K to all the crops in sequence it showed negative nitrogen balance. Further increment in weed compost showed higher magnitude of improvement in nitrogen balance. The higher positive N balance recorded under the crops in sequence fertilized with both organic and inorganic sources of nutrients might be due to the fact that organic manure helps to reduce the losses of nitrogen from the soil. Similar type of result was recorded by Bhat *et al.* (2005), Hemalatha *et al.* (2000). Also the result is corroborated with the findings of Brahmachari (1996). They reported organic nutrient sources in conjugation with mineral fertilizer improved the post harvest nutrient status of soil over mineral fertilizer application.

Interaction effect of weed and nutrient management

The maximum negative N balance (-165.36 kg ha^{-1}) was recorded where the crop received N_1 (100% recommended NPK) with combination with W_1 (farmer practice HW at 21 DAS / DAT) treatment and it was closely followed by that (-120.58 kg ha^{-1}) observed under treatment receiving W_3N_1 [100% recommended dose of NPK in combination with quizalofop-ethyl 5EC at 30 DAS (greengram), pretilachlor 37.5 EC (rice) at 3 DAT, oxyfluorfen 23.5 % (onion) at 4 DAT)]. The maximum positive N balance (+386.40kg ha^{-1}) in the treatment combination W_2N_6 followed by W_3N_6 (+345.52kg ha^{-1}). It is clear from the data that in W_2 with increment of weed compost nitrogen balance also increased than W_1 in combination with 100 % NPK through fertilizer (Table 2) application.

Table 2: Effect of integrated weed and nutrient management on balance sheet of total nitrogen after two cropping cycles of greengram-rice-onion cropping sequence

Treatments	Nitrogen source (kg ha^{-1})			Nitrogen recovery (kg ha^{-1})			Nitrogen balance (kg ha^{-1})
	Initial value	Nitrogen added	Total	Final value	Crop uptake	Total	
Integrated weed management (W)							
W_1	1205.60	360.00	1565.60	1326.13	329.63	1655.75	90.15
W_2	1205.60	360.00	1565.60	1336.65	424.39	1761.04	195.44
W_3	1205.60	360.00	1565.60	1331.38	374.45	1705.83	140.23
Integrated nutrient management (N)							
N_1	1205.60	360.00	1565.60	1197.69	244.62	1442.32	-123.28
N_2	1205.60	360.00	1565.60	1294.87	326.33	1621.20	55.60
N_3	1205.60	360.00	1565.60	1338.20	359.85	1698.05	132.45
N_4	1205.60	360.00	1565.60	1363.82	400.18	1764.00	198.40
N_5	1205.60	360.00	1565.60	1383.36	435.50	1818.86	253.26
N_6	1205.60	360.00	1565.60	1410.35	490.45	1900.80	335.20
W×N							
W_1N_1	1205.60	360.00	1565.60	1193.37	206.87	1400.24	-165.36
W_1N_2	1205.60	360.00	1565.60	1295.22	275.46	1570.68	5.08
W_1N_3	1205.60	360.00	1565.60	1322.24	323.20	1645.43	79.83
W_1N_4	1205.60	360.00	1565.60	1357.36	360.59	1717.95	152.35
W_1N_5	1205.60	360.00	1565.60	1384.07	376.87	1760.94	195.34
W_1N_6	1205.60	360.00	1565.60	1404.51	434.77	1839.28	273.68
W_2N_1	1205.60	360.00	1565.60	1201.33	280.36	1481.69	-83.91
W_2N_2	1205.60	360.00	1565.60	1287.41	379.21	1666.62	101.02
W_2N_3	1205.60	360.00	1565.60	1342.40	407.24	1749.63	184.03
W_2N_4	1205.60	360.00	1565.60	1376.82	453.47	1830.30	264.70
W_2N_5	1205.60	360.00	1565.60	1391.11	494.87	1885.98	320.38
W_2N_6	1205.60	360.00	1565.60	1420.81	531.19	1952.00	386.40
W_3N_1	1205.60	360.00	1565.60	1198.38	246.65	1445.02	-120.58
W_3N_2	1205.60	360.00	1565.60	1301.98	324.33	1626.30	60.70
W_3N_3	1205.60	360.00	1565.60	1349.97	349.13	1699.10	133.50
W_3N_4	1205.60	360.00	1565.60	1357.29	386.47	1743.76	178.16
W_3N_5	1205.60	360.00	1565.60	1374.91	434.76	1809.68	244.08

Variable uptake of N by crops and weeds along with greater retention of N through reduction of losses by volatilization, denitrification, leaching or runoff etc might be the reason behind these results.

Changes in weed management practices had a significant effect in changing the system yield based on rice equivalent yield. From the pooled analysis it was found that the system yield differed significantly with the different nutrient management practices. The system pooled yield of the greengram-rice-onion cropping system increased with increasing levels of weed compost. Nitrogen balance was positive under all treatments of weed management ranging from 90.15 to 195.44 kg ha^{-1} after completion of two cropping cycles. Positive Nitrogen balance was recorded under all treatments except for N_1 where 100% recommended NPK was applied through fertilizers. Only negative balance was recorded in case of N_1 (-123.28 kg ha^{-1}). Maximum N balance was recorded in case of N_6 (40 % recommended N + 20 % N through neemcake + 40 % N through weed compost + full PK) (+335.20) which was followed by N_5 (+253.26 kg ha^{-1}), N_4 (+198.40 kg ha^{-1}) and N_3 (+132.45 kg ha^{-1}), respectively. Treatment W_2 with increment of weed compost, Nitrogen balance increased considerably than W_1 in combination with

100% NPK through inorganic fertilizer. With increment of weed compost keeping fixed amount of neemcake, inorganic nitrogen can be reduced up to 50% which influenced system yield and nitrogen balance sheet increment significantly.

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REFERENCES

Acharya, D. and Mondal, S. S. 2010. Effect of integrated nutrient management on the growth, productivity and quality of crops in rice (*Oryza sativa*) - cabbage (*Brassica oleracea*) green gram (*Vigna radiata*) cropping system. *Indian J. Agron*., **55**: 1-5.

Bedi, P. and Dubey, Y. P. 2009. Long-term influence of organic and inorganic fertilizers on nutrient build-up and their relationship with microbial properties under a rice-wheat cropping sequence in an acid alfisol. *Acta Agronomica Hungarica*, **57**: 297-306.

Brahmachari, K. 1996. Nutrient management with special reference to potassium, sulphur and organic manure/matter on yield and quality development of crops in jute-rice-rapeseed sequence. *Ph.D. Thesis.* Submitted to Department of Agronomy, BCKV, Mohanpur, Nadia, West Bengal.

Dobermann, A., and White, P. F. 1999. Strategies for nutrient management in irrigated and rainfed lowland rice systems. *Nutrient Cycling Agroecosystem*, **53**: 1-18.

Gaikwad, C. B., Gaikwad, J. H. and Kasture, M. C. 2009. Farmers' awareness about Parthenium hysterophorus and its ill effect on agriculture, environment and health of human and livestock. *Agric. Update*, **4**: 13-16.

Gomez, K.A. and Gomez, A.A. 1984. *Statistical Procedure for Agricultural Research*, 2nd Edn. International Rice Research Institute, Wiley, New York.

Hemalatha, M., Thirumurugan, V. and Balasubramanian, R. 2000. Effect of organic sources of nitrogen on productivity, quality of Rice and soil fertility in single crop wetlands. *Indian J. Agron*., **45**: 564-67.

Jackson, M. L. 1973. *Soil Chemical Analysis*. Prentice Hall of India Private Ltd., New, Delhi, pp. 498.

Kori, R.N., Salakinkoppa, S.R., Potdar, M.P. and Ekbote, S.D. 1997. Effect of weed control on nutrient uptake, weed weight and yield of groundnut. *World Weeds*, **4**: 149-53.

Mandal, B., De, P. and De, G.C. 2002. Efficiency of herbal leaves on weed management of transplanted *Kharif* rice. *J. Interacad*., **6**: 109-12.

Munda, G.C., Patel, D.P., Das, A., Kumar, R. and Chandra, A. 2006. Production potential of rice (*Oryza sativa*) under in situ fertility management as influenced by variety and weeding. *J. Eco-friendly Agric*., **1**:12-15.

Raghuwanshi, R.K.S., Umat, R., Nema, M.L. and Dubey, D.D. 1991. Balance sheet of nitrogen, phosphorus and potash in soil as influenced by wheat (*Triticum aestivum*) – based crop sequence. *Indian J. Agron.*, **36**: 322-25.

Sidhu, B.S. and Beri, V. 1989. Effect of crop residue management on the yield of different crops and on soil properties. *Biol. Wastes.*, **27**:15-27.

Singh, D.D. 2003. Management of crop residue in summer rice and its effect on the soil properties and crop yield. *Crop Res.*, **25**:191–93.

Singh, R. and Yadav, D.S. 2006. Effect of rice (*Oryza sativa*) residueand nitrogen on performance of wheat (*Triticum aestivum*) under rice-wheat cropping system. *Indian J. Agron*., **51**: 247–50.

Srivastava, L.L., Mishra, B. and Srivastava, M.C. 1988. Recycling of organic waste in relation to yield of wheat and rice and soil fertility. *J. Indian Soc. Soil Sci.*, **36**:693-97.

Witt, C., Cassman, K.G., Olk, D.C., Biker, U., Liboon, S.P., Samson, M.I. and Ottow, J.C.G. 2000. Crop rotation and residue management effects on carbon sequestration, nitrogen cycling and productivity of irrigated systems. *Pl. Soil*, **225**: 263–78.

Yadav, A. and Chauhan, S.V.S. 1998. Studies on allelopathic effect of some weeds. *J. Phytol. Res.*, **11**: 15-18.