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Effect of sunflower residue incorporation, method of establishment and nutrient management on weed population and dry matter in rice

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Abstract
A field experiment was conducted at main research farm of OUAT, Bhubaneswar, Odisha. The experiment was laid out in double split design with 27 treatment combinations and three replications. In main plot sunflower residue was removed in one plot, incorporated in another plot and in third plot no sunflower was grown. In subplot three methods of establishment of rice was taken namely dry direct seeded, wet direct seeded and transplanting method of rice establishment. Three different nutrient management practices was given to rice in sub sub plot i.e. first is fully organic where only FYM was used as nutrient source, in second one integrated approach was followed through 75 percent of nitrogen through inorganic nutrient source with 25 percent of organic source and the third case is pure inorganic where only chemical fertilizer was given at the rate of 60-30-30 kg of N-P_2O_5-K_2O per ha. Weed observations were recorded after 20 and 40 DAS/DAT by help of quadrant method. Significantly lower weed number and weed dry weight was observed in sunflower residue incorporation and with transplanting method during both the years of experimentation.

Keywords: Weed population, dry matter, residue incorporation, rice, sunflower

Introduction
Rice (*Oryza sativa*) based cropping system is the most dominant cropping system in the state like Odisha. Continuous cultivation of rice for longer periods 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 thereby low system productivity. Rice crop is of global importance as it feeds more than half of the world's population and more than 90 per cent of world rice is grown and consumed in Asia. In Odisha, rice is the central theme to many festivals and community interactions and is grown in 4.4 m ha with production of 7 m ton and average productivity of 1.60 t/ha. Weed possesses a major problem in crop production accounting for huge yield loss in rice. So management of weeds in rice is a major concern. There are so many evidences of allelopathic effect of sunflower residue on weeds. Here in this experiment attempt has been made to observe allelopathic effect on weeds due to growing and incorporation of sunflower residue before growing of rice under different methods of establishment and nutrient management practices.

Materials and Methods
The experiment was conducted during 2016-17 and 2017-18 at main research farm of OUAT, Bhubaneswar, Odisha. The experiment was laid out in double split design with 27 treatment combinations and three replications. In main plot sunflower treatment was taken, in first plot sunflower was grown only, in second plot sunflower was grown along with incorporation of the sunflower residue and the third main plot was taken as control where no sunflower was grown. After sunflower rice was taken in the sub plot with three established methods as dry direct sowing, wet direct sowing and transplanted. Three different nutrient management practices was given to rice in sub sub plot i.e. first is fully organic where only FYM was used as nutrient source, in second one integrated approach was followed through 75 percent of nitrogen through inorganic nutrient source with 25 percent of organic source and the third case is pure inorganic where only chemical fertilizer was given at the rate of 60-30-30 kg of N-P_2O_5-K_2O per ha. After harvest of rice, green gram crop was taken under residual soil moisture and soil nutrient status. The variety used for rice was Naveen. Weed observations were recorded after 20 and 40 DAS/DAT by help of quadrant method.

Results and Discussion

Weed population

The number of weeds per m^2 as influenced by sunflower residues incorporation, method of establishment and source of nutrient in the crop experimental site were presented in Table 1.

Weeds m^{-2} at 20 DAS/ DAT

During 2016-17, among the sunflower residue related plot, significantly highest number of weeds was recorded in the control plot (24.5 m^{-2}) followed by sunflower residue removal (23.5 m^{-2}) and sunflower residue incorporation (22.3 m^{-2}). During 2017-18 also, significantly highest number of weeds was recorded in the control plot (23.2 m^{-2}). Among the methods of establishment, highest number of weeds were recorded in dry direct sowing (26.7 m^{-2}) which was higher than wet direct sowing and transplanting methods by 34.1 per cent and 42.8 per cent, respectively. Weed count did not differ significantly due to source of nutrient treatments in both the years under study. Numerically, lowest weed count was noticed in organic (100 % N FYM) source of nutrient and RDF during 2016-17 and 2017-18, respectively.
The interaction effect was found to be non significant.

Weeds m^{-2} at 40 DAS/ DAT

Among the sunflower residue treatments, during 2016-17, the significantly higher number of weeds was recorded in the control (42.7 m^{-2}) which was followed by sunflower residue removal (40.6 m^{-2}) and sunflower residue incorporation (38.7 m^{-2}). Similar trend in number of weeds among the sunflower residue treatments followed in the subsequent year as well. Among the methods of establishment, significantly lesser number of weeds was recorded in wet direct sowing and transplanting in both the years. The differences in weed count due to change in source of nutrient were non-significant in both the years of study. Numerically, lowest weed count was noticed in organic (100 % N FYM) source of nutrient.
The interaction effect was found to be non significant.

Table 1: Number of weeds in rice as influenced by sunflower residues incorporation, method of establishment and source of nutrient

Treatment	Weeds m^{-2}					
	20 DAS/ DAT			40 DAS/DAT		
	2016	2017	Pooled	2016	2017	Pooled
Sunflower residues						
Removal	23.5	22.2	22.9	40.6	39.0	39.8
Incorporation	22.3	21.3	21.8	38.7	38.1	38.4
Control	24.5	23.2	23.8	42.7	41.1	41.9
SEm±	0.19	0.26	0.16	0.33	0.28	0.22
CD(0.05)	0.67	0.91	0.42	1.15	0.99	0.57
Method of establishment						
Dry direct sowing	26.7	25.1	25.9	47.0	45.5	46.2
Wet direct sowing	19.9	19.5	19.7	38.6	36.0	37.3
Transplanting	18.7	18.0	18.4	33.5	32.8	33.1
SEm±	0.18	0.27	0.16	0.39	0.32	0.25
CD(0.05)	0.55	0.83	0.40	1.16	0.97	0.61
Source of nutrient						
Organic(100 % N FYM)	24.1	23.3	23.7	42.4	41.0	41.7
75% RDN+25 % N Organic	24.7	23.4	24.1	42.9	41.2	42.0
RDF	24.4	22.9	23.6	42.8	41.2	42.0
SEm±	0.25	0.31	0.28	0.27	0.27	0.25
CD(0.05)	NS	NS	NS	NS	NS	NS

Weed dry matter in rice

Total dry weight of weeds in rice (g m^{-2}) differed significantly due to sunflower residues incorporation, method of establishment and source of nutrient and has been presented in Table 2.

Weed dry weight (g m^{-2}) at 20 DAS/DAT

Among the sunflower residue treatments, during 2016-17, the significantly lower weed dry weight was recorded in sunflower residue incorporation (24.2 g m^{-2}) which was lesser than sunflower residue removal (26.3 g m^{-2}) and control (27.2 g m^{-2}). Similar trend in weed dry weight among the sunflower residue treatments followed in the subsequent year as well where sunflower residue incorporation (23.8 g m^{-2}) recorded the lowest weed dry weight. Among the methods of establishment, significantly lesser weed dry weight was recorded in transplanting with weight of 15.4 g m^{-2} and 17.1 g m^{-2} in 2016-17 and 2017-18, respectively. The differences in weed dry weight due to change in source of nutrient were non-significant in both the years of study. Numerically, lowest weed dry weight was noticed in organic (100 % N FYM) source of nutrient and 75% RDN+25 % N organic during 2016-17 and 2017-18, respectively.
The interaction effect was found to be non significant.

Weed dry weight (g m^{-2}) at 40 DAS/DAT

During 2016-17, among the sunflower residue related plot, significantly lower weed dry weight was recorded in the sunflower residue incorporation plot (69.7 g m^{-2}) which was lesser than sunflower residue removal (71.1 g m^{-2}) and control (73.6 g m^{-2}). During 2017-18 also, significantly lower weed dry weight was recorded in sunflower residue incorporation (70.0 g m^{-2}). During 2016-17, among the methods of establishment, lowest weed dry weight were recorded in transplanting (56.7 g m^{-2}) which was lesser than wet direct sowing and dry direct sowing methods by 16.6 per cent and 33.8 per cent, respectively. Similar trend in weed dry weight was observed in 2017-18 due to different methods of establishment. Weed dry weight did not differ significantly due to source of nutrient treatments in both the years under study.
The interaction effect was found to be non significant.
There was significant reduction of weed number in sunflower residue incorporated plot. This might be due to inhibition of weed growth by allelopathic effect of sunflower residue. Sunflower rhizosphere soil reduces the seedling growth (population, plant height) and yield attributes (seed and biomass) of *P. hysterophorus* and *Trianthema portulacastrum* weeds in pot experiments. The effect of such soil was due to the presence of allelochemicals (p-hydroxybenzoic acid, vanillic acid, caffic acid, ferulic acid) released by sunflower roots in soil (Rawat *et al*., 2011) [10]. Mubeen *et al*. (2012) [7] studied the allelopathic effects of water extracts of sorghum and sunflower alone and in combination on the germination and seedling growth of weeds. Combined application of sorghum and sunflower water extract significantly reduced the shoot dry weight per seedling of *Trienthema portulacastrum* over control. Allelochemical compounds decreased photosynthesis, leaf area and dry mass of target plants (Lorenzo *et al*., 2011; Farhoudi and Lee, 2012) [5, 2, 3]. Increases in evidences also suggest that allelopathic mechanisms can raise oxidative stresses which are underlying components of most abiotic stresses (Oracz *et al*., 2007) [8]. Allelochemicals such as phenolic (Alsaadawi *et al*., 2010) and terpenoids (Macias *et al*., 2002) [6] compounds have been

found in the most suppressive potential sunflower genotypes which have high impacts in other plant growth. Allelochemicals associated in sunflower extracts also influences on biochemical and developmental processes such as reduction of sucrose synthase activity and seedling growth in wild oat (Farhoudi *et al*., 2012) [2, 3]. The same trend was also followed in case of weed dry weight. The lowest weed dry weight was observed in plots where sunflower residue was incorporated. With respect to methods of establishment, more weed number as well as weed dry weight was found in direct seeded rice compared to transplanted and wet direct seeded (Table 4.5 and 4.10). This might be due to skipping of puddling operation in DSR method. Generally puddling helped in complete destruction of weeds and maintenance of water layer in both transplanted and wet seeded rice which in turn suppressed the weed population. Transplanting methods effectively suppress the rice weeds by preventing the light to reach the weeds through a layer of standing water (Farooq *et al.*, 2011) [4]. Weeds are serious problems in DSR because dry tillage practices and aerobic soil conditions are conducive for germination and growth of weeds which can cause grain yield losses from 50 to 90 per cent (Prasad, 2011).

Table 2: Weed dry weight in rice as influenced by sunflower residues incorporation, method of establishment and source of nutrient

Treatment	Weed dry weight (g m^{-2})					
	20 DAS/DAT			40 DAS/ DAT		
	2016	2017	Pooled	2016	2017	Pooled
Sunflower residues						
Removal	26.3	25.9	26.1	71.1	71.7	71.4
Incorporation	24.2	23.8	24.0	69.7	70.0	69.8
Control	27.2	27.7	27.5	73.6	74.1	73.9
SEm±	0.51	0.54	0.37	0.29	0.19	0.17
CD (0.05)	1.77	1.86	0.98	1.02	0.67	0.46
Method of establishment						
Dry direct sowing	32.3	30.8	31.6	85.6	84.1	84.9
Wet direct sowing	20.0	18.5	19.2	68.0	66.6	67.3
Transplanting	15.4	17.1	16.7	56.7	55.2	56.0
SEm±	0.38	0.27	0.23	0.34	0.29	0.23
CD (0.05)	1.13	0.82	0.57	1.03	0.88	0.55
Source of nutrient						
Organic (100 % N FYM)	25.9	25.3	26.1	73.4	71.9	72.6
75% RDN+25 % N Organic	26.4	25.0	26.7	73.5	72.3	72.9
RDF	26.3	25.1	26.4	73.4	71.8	72.6
SEm±	0.25	0.27	0.28	0.26	0.25	0.25
CD (0.05)	NS	NS	NS	NS	NS	NS

Conclusion

Significantly lower weed number and weed dry weight was observed in sunflower residue incorporation (21.8 m^{-2} and 24 g m^{-2}) and with transplanting method (18.4 m^{-2} and 16.7 g m^{-2}) at 20 DAS during both the years of experimentation. No significant difference was found with respect to source of nutrients. Similar trend was observed at 40 DAS.

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References

1. Alsaadawi IS, Sarbout AK, Al-Shamma ALM. Differential allelopathic potential of sunflower (*Helianthus annuus* L.) genotypes on weeds and wheat (*Triticum aestivum* L.) crop, Archives of Agronomy and Soil Science. 2012; 58(10):1139-1148.
2. Farhoudi R, Lee D. Evaluation of safflower (*Carthamus tinctorius* L. cv. Koseh) extract on germination and induction of α-amylase activity of wild mustard (*Sinapis arvensis* L.) seeds. Seed Science and Technology, 2012; 40(1):135-139.
3. Farhoudi R, Modhej A, Koreshnejad N. Effect of Allelopathic extracts of wheat (*T. aestivum c.v Chamran*) on germination, vegetative growth, cell membrane damage, α- amylase and sucrose synthesis activity of Avena ludoviciana, Iranian Plant Protection. 2012; 12:16-24.
4. Farooq MK, Siddique HM. Rice direct seeding: experiences, Challenges and opportunities, Soil Tillage research. 2011; 111(2): 87-98.
5. Lorenzo P, Palomera-Pe´rez A, Reigosa MJ, Gonza´l L. Allelopathic interference of invasive Acacia dealbata Link on the physiological parameters of native understorey species, Plant Ecology. 2011; 212:403-411.
6. Macias FA, Varela RM, Torres A, Galindo JLG, Molinillo JMG. Allelochemicals from sunflowers: chemistry, bioactivity and applications, in Inderjit and A. U. Mallik (eds.). Chemical Ecology of Plants: Allelopathy in Aquatic and Terrestrial Ecosystems. Birkhauser Verlag, Basel, 2002, 73-87
7. Mubeen K, Nadeem MA, Tanveer A, Zahir ZA. Allelopathic effects of sorghum and sunflower water extracts on germination and seedling growth of rice (*Oryza sativa* L.) and three weed species. The Journal of Animal and Plant Sciences, 2012; 22(3):738-746.
8. Oracz K, Bailly C, Gniazdowska A, Come D, Corbineau D, Bogatek R. Induction of oxidative stress by sunflower phytotoxins in germinating mustard seeds, J. Chem Ecol, 2007; 33:251-264.
9. Prasad R. Aerobic rice systems, Advances in Agronomy. 2011; 111:207-247.
10. Rawat LS, Narwal SS, Kadian HS, Negi VS. Allelopathic effects of sunflower (*Helianthus annuus*) on germination and growth of *Parthenium hysterophorus*, Allelopathy Journal. 2011; 27(2):225-236.