J. of Plant Production, Vol. 1 (4): 565 - 578, 2010

EFFECT OF SOME SOIL AMENDMENTS AND WEED CONTROL TREATMENTS ON GROWTH AND YIELD OF RICE

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ABSTRACT

Two field experiments were carried out at a private Farm in El-Abhar village, El-Hamoul Count, Kafr El-Sheikh Governorate during 2007 and 2008 seasons. The main objectives were to study the effect of soil amendments *i.e.* control, gypsum at the rate of 2.5 and 5.0 t/fed, farmyard manure (FYM) at the rate of 5 and 10 t/fed and sulphur at the rate of 75 and 150 kg/fed) and weed control treatments (hand weeding and chemical control with Saturn, Basagran, Nominee and Sirius) on weed characters, growth, yield components as well as grain and straw yields of Giza 178 rice cultivar. The experiments were carried out in strip plot design with four replications in both seasons.

The main results could be summarized as follows:

1. Application of FYM at the rate of 10 t/fed produced the lowest values of number, fresh and dry weights of barnyard grass and the highest values of growth, yields and its components of rice in the two growing seasons. However, the lowest values of number, fresh and dry weights of flatsedge were resulted from application of gypsum at 5.0 t/fed in the first seasons and application of sulphur at 150 kg/fed in the second season. Whereas, application of gypsum at 2.5 t/fed lead to obtain the lowest values of number, fresh and dry weights of jungle rice in both growing seasons.
2. Using bispyribac sodium (Nominee 2 % SL) at the rate of 800 cm^3/fed after 23 days from sowing (DFS) minimized number, fresh and dry weights of barnyard grass and jungle rice and resulted the maximum values of growth, yields and its components of rice in both seasons. However, the minimum number, fresh and dry weights of flatsedge were resulted from application of thiobencarb (Saturn 50 % EC) at the rate of 2 L/fed after 9 DFS in both seasons.
3. The interaction between soil amendments and weed control treatments had a significant effect on all studied character of weeds and rice, except number of barnyard grass in the second seasons, dry weight of barnyard grass in the first season, number of Jungle rice in the first season and dry weight of Jungle rice in the second season.

According to the obtained results from this study, it can be concluded that, application FYM at the rate of 10 t/fed or gypsum at the rate of 5.0 t/fed and using bispyribac sodium could be recommend to raise rice productivity under the environmental conditions of El-Hamoul district, Kafr El-Sheikh Governorate.

Keywords: Rice, *Oryza sativa* L., soil amendment, farmyard manure, gypsum, sulphur, weed control, herbicides, yield, quality.

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important staple food for more than 60 percent of world's population. In Egypt, it is one of the major field crops, where preferred by most Egyptians and contributes to about 20 % of capita cereal consumption. Rice farming, engages one million families, which

corresponds to about 10 % of the Egyptian population. Increasing rice productivity per unit area is a requisite to meet the unconsistent demand. Increasing rice productivity can be achieved through optimizing the cultural practices such as soil conditioning by using soil amendments and applying suitable weed control.

A soil amendment is any material added to improve soil physical properties, such as water retention, permeability, water infiltration, aeration and structure. The goal behinde using soil amendment is to provide a better environment for roots growth. Organic and inorganic are two broad categories of soil amendments. Organic amendments come from something that was alive such as straw, compost, and manures. On the other hand, inorganic amendments are either mined or man-made such as vermiculite, perlite, gypsum and sulphur (Davis and Wilson, 2006).

Organic fertilizers, such as farmyard manure provides with some nutrients and reduced the risk of environmental pollution and improved soil fertility, consequently increasing rice productivity (Rasool *et al.*, 2007 ; Singh *et al.*, 2007 ; Majumder *et al.*, 2008 ; Ming-gang *et al.,* 2008 ; Bi *et al.*, 2009 and Masulili, 2010) and also lowered soil pH and sodium absorption ratio (SAR) due to acidic effect (Sarwar *et al.,* 2007).

Agricultural gypsum used to loosen heavy clay soils, whereas releases nutrients and improves soil structure and also increase grain yield of rice and its components (Sharma and Singh, 1984 ; Chhabra, 1999 ; Khan *et al.*, 2007 and Reichenauer *et al.*, 2009). Elemental sulfur led to lower pH in alkaline soils and increased grain yield of rice (Yasmin *et al.,* 2007).

Weed control is a basic practice in seeded – rice of Egypt. Weeds compete for light, nutrients and water. In addition, its harbor various pests insects and act as a host for many diseases (Badawi *et al.*, 2001). Many investigations cleared the effect of weed control treatments on rice productivity. In this connections, El-Mashad *et al.* (1995) indicated that rice grain yield almost decreased in unweeded plots. Sindax + Ronstar (80 g + 0.75 L/fed) and Ronstar + Saturn (0.75 L + 2.0 L/fed) combinations were comparable for three times hand weeding from view point of weed control and grain yield. They concluded that such treatments could be recommended for weed control on seeded rice. Ibrahim *et al.* (1995) indicted that Saturn herbicide could be recommended for weed control in direct seeded - rice. Bassal *et al.* (1998) reported that weed control treatments had significant effects on all studied characters. The use of the herbicide (Saturn 50 % 2.0 L/fed) plus weed free treatment significantly increased grain yield through increasing yield components. Fresh weight of weeds was significantly reduced due to using herbicide as compared to hand weeding (once) and control treatment (without weeding). Liebman and Davis (1999) revealed that organic soil amendments and crop diversification are basic components of low-external-input (LEI) systems. Weed scientists can improve the use of these practices for weed management by improving ecological mechanisms. Additions of organic materials can change the incidence and severity of soil-borne diseases affecting weeds and crops. Palis *et al.* (1999) showed that bispyribac sodium (Nominee) herbicide gave excellent efficiency against

Echinochloa crus – galli (L.) Beaur and *Cyperus difformis* L. Moshtohry (2001) reported that bispyribac (Nominee) as a sulphonyl urea herbicide gave the highest effect on controlling *Echinochloa crus – galli* (L.) Beaur and *Cyperus difformis* L. compared to thiobencarb (Saturn) as a recommended herbicide. Also seed yield of rice increased by 3.12 t/fed. Abd El-Wahed *et al.* (2003) found that thiobencarb (Saturn) significantly decreased vegetative characteristics, yield, photosynthetic pigments of flag leaf, sugar, protein and indoles contents of all rice plant organs. El-Desoki (2003) indicated that when weeds were allowed to grow with the crop, grain yield was reduced by about 62.03 % compared to twice hand-weeded treatment after 20 and 40 days from transplanting. He concluded that all weed control treatments increased rice grain and straw yields and decreased dry weight of weeds. Shalaby (2005) concluded that the application of 0.06 kg a.i./fed of bispyribac – sodium plus 0.010 kg a.i./fed of pyrazosulfuron – ethyl increased all studied characters. But, lower values for those characters were resulted from either hand weeding or the three rates of bentazone. Ebaid and Shebl (2006) indicated that Saturn 50 % EC was the most effective method for weed control in rice followed by hand weeding, which recorded the highest rice yields and lowest weed dry weight compared with weedy check.

Therefore, the objective of this study was to determine and evaluate the effects of some soil amendments and weed control treatments as well as their interactions on weed characters, growth, yield components as well as seed and straw yields of rice under newly reclaimed soils in El-Hamoul district. The goal is to supply groundwork and knowledge for establishing appropriate and sustainable rice cultivation in newly reclaimed soils.

MATERIALS AND METHODS

The field experiments were carried out at a private Farm in El-Abhar village, El-Hamoul Center, Kafr El-Sheikh Governorate during 2007 and 2008 seasons to study the effect of some soil amendments and weed control treatments as well as their interactions on weed characters, growth, yield components as well as grain and straw yields of Giza 178 rice cultivar.

The experiments were carried out in strip plot design with four replications. The vertical plots were occupied with the following seven soil amendments treatments: without (control treatment), agricultural gypsum at the rate of 2.5 and 5.0 t/fed, farmyard manure (FYM) at the rate of 5 and 10 t/fed and sulphur at the rate of 75 and 150 kg/fed. The agricultural gypsum (80 % Calcium Sulphate slow released, 0.5 % P_2O_5, 6 % Ca and 13 % S) and sulphur (Acta-print – Altrafine) were obtained from the Agricultural Cooperation of El-Tayeba, El-Hamoul, Ministry of Agriculture and Land Reclamation. Chemical analysis of used Farmyard manure (FYM) is shown in Table 1.

The horizontal plots were assigned to five weed control treatments as follows:, twice hand weeding after 25 and 40 days from sowing (DFS) *i.e.* control treatment, Saturn 50 % EC at the rate of 2 L/fed after 9 DFS, Basagran 48 % AS at the rate of 1.5 L/fed after 23 DFS, Nominee 2 % SL at

the rate of 800 cm^3/fed after 23 DFS and Sirius 10 % WP at the rate of 100 g/fed after 12 DFS. These herbicides were sprayed through knapsack sprayer with 100 liters of water per feddan on drained soil (two days before treatment) and the water was introduced after 1 to 2 days according to the herbicides.

The experimental plot area was 3.0 m width and 3.5 m length, resulted an area of 10.5 m^2 (1/400 fed). The preceding winter crop was Egyptian clover (*Trifolium alexandrinum* L.) in both seasons.

Table 1: Chemical analysis of Farmyard manure (FYM) samples during both seasons.

Properties	2007	2008
Moisture %	8.5	9.6
Organic matter %	53.0	54.5
Total N (%)	1.17	1.19
P (%)	0.45	0.56
K (%)	1.20	1.31
C : N ratio	26:1	28:1

Random soil samples were taken from the experimental field to measure the physical and chemical soil properties according to Jackson (1973). The corresponding data are presented in Table 2.

Table 2: Mechanical and chemical soil characteristics at the experimental site during the two growing seasons of 2007 and 2008.

Soil analysis	2007	2008
A: Mechanical properties:		
Sand (%)	12.4	12.5
Silt (%)	26.5	26.2
Clay (%)	61.1	61.3
Texture	Clayey loamy	Clayey loamy
$CaCo_3$ (%)	1.23	1.50
B: Chemical analysis		
Soil reaction pH	8.0	8.2
EC (ds/m^2) in soil water extraction (1:5) at 25^0C	3.2	3.0
Organic matter (%)	1.89	1.90
Available N (ppm)	86.0	86.3

The experimental field was prepared as recommended. Calcium superphosphate (15.5 % P_2O_5) was added at the rate of 100 kg/fed during plowing on dry surface. Soil amendments (agricultural gypsum, farmyard manure and sulphur) were distributed in vertical plots before wet leveling and divide to experimental units (10.5 m^2). Seeds of Giza 178 rice cultivar at the rate of 60 kg/fed were soaked for 36 hours and incubated for another 36 hours before broadcasting on 25th and 22nd May in 2007 and 2008 seasons, respectively. Normal watering management, at four to six days was followed.

Nitrogen fertilizer in the form urea (46 % N) was added at the rate of 60 kg N/fed in two equal portions. The first part was added after 30 days from sowing, whereas the second was added after 20 days from the first one. Potassium in the form of potassium sulphate (48 % K_2O) was added at the rate of 24 kg K_2O/fed with the first dose of nitrogen fertilizer. Zinc sulphat at the rate of 10 kg/fed were add after puddling. However, commonly other agricultural practices according to the recommendations of Ministry of Agriculture for growing rice were followed.

Data recorded:

I) weeds:

1- Number of weeds/m^2: After 50 days from sowing the number of weeds in one random quadrate (1 m^2) from each plot were recorded by spices as barnyardgrass (*Echinochloa crus – galli* (L.) Beaur), flatsedge (*Cyperus difformis* L.) and Jungle rice (*Echinochloa colonum* (L.) Link).

2- Fresh weight of weeds/m^2: The previous counted weeds were cleaned, left for sun drying for two hours, then weight was recorded as grams per square meter.

3- Dry weight of weeds/m^2: Weights of weed species were recorded after drying at 105 °C for 48 hours.

II) <u>Rice:</u>

A. Growth characters:

1- Flag leaf area (cm^2): At maximum tillering stage, the leaf area of flag leaf was estimated by using the formula reported by Yoshida *et al.* (1976) as follows:

Flag leaf area (cm^2) = K x Length (cm) x width (cm). Where: K (0.75).

B. Yield and its components:

At harvest, the following data were recorded:

2- Plant height (cm).
3- Number of panicles/m^2.
4- Panicle length (cm).
5- Number of grains/panicle.
6- 1000- grain weight (g.

7- Grain yield (t/fed): Plants in the inner four square meter of each experimental unit were harvested, labeled and tied. Thereafter, plants were transported to the threshing floor for air drying for five days, then the plants were threshed and the grains were separated. The grain yield was recorded in kg/4 m^2, and then it was converted to record grain yield t/fed at 14 % moisture content.

8- Straw yield (t/fed): It was estimated using the same steps for grain yield.

All data of this study were statistically analyzed according to the technique of analysis of variance (ANOVA) for strip plot design as published by Gomez and Gomez (1984), by using “MSTAT-C” computer software package. Least Significant Difference (LSD) method was used to test the differences between treatment means at 5 % level of probability as described Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1- Weed characters:

1.1- Soil amendments effects:

Data presented in Table 3 revealed that soil amendments had a significant effect on number, fresh and dry weights of dominant weeds in rice fields *i.e.* barnyard grass (*Echinochloa crus – galli* (L.) Beaur), flatsedge (*Cyperus difformis* L.) and Jungle rice (*Echinochloa colonum* (L.) Link) during both seasons. From the obtained results, it could be observed that there are inconstant trend for the effect of soil amendments on weed characters in both seasons. So that, the best soil amendment that reduced number, fresh and dry weights of barnyard grass was application farmyard manure at 10 t/fed during both seasons. However, the lowest values of number, fresh and dry weights of flatsedge were resulted from the application of gypsum at 5.0 t/fed in the first seasons and application of sulphur at 150 kg/fed in the second season. Whereas, application of gypsum at 2.5 t/fed lead to obtain the lowest values of number, fresh and dry weights of jungle rice in both seasons. These results might be due to the desirable impact of soil amendments as a source of nutrients, maintains good soil structure and improves the productivity of soil by promoting infiltration rate and aeration in soil, which in turn of increasing competition between weeds and rice in the interest of rice and decreasing weed characters. These results are in partial agreement with those stated by Singh *et al.* (2007), Majumder *et al.* (2008), Reichenauer *et al.* (2009) and Masulili (2010).

1.2- Weed control treatments effects:

Weed control treatments (hand weeding and some herbicides) exhibited significant effect on number, fresh and dry weights of barnyard grass (*Echinochloa crus – galli* (L.) Beaur), flatsedge (*Cyperus difformis* L.) and Jungle rice (*Echinochloa colonum* (L.) Link) during the two growing seasons (Table 3). Using bispyribac sodium (Nominee 2 % SL) at the rate of 800 cm^3/fed after 23 DFS minimized number, fresh and dry weights of barnyard grass and Jungle rice followed by using thiobencarb during both seasons. However, the minimum number, fresh and dry weights of flatsedge were resulted from application of thiobencarb (Saturn 50 % EC) at the rate of 2 L/fed after 9 DFS followed by Bentazone (Basagran 48 % AS) at the rate of 1.5 L/fed after 23 DFS in both seasons. On the other hand, hand weeding twice after 25 and 40 DFS (control treatment) associated with the highest number, fresh and dry weights of dominant weeds in both seasons. Similar results were obtained by El-Mashad *et al.* (1995), Bassal *et al.* (1998), Palis *et al.* (1999), El-Desoki (2003) and Ebaid and Shebl (2006).

Data in Table 3 showed that the interaction between soil amendments and weed control treatments had a significant effect on number, fresh and dry weights of barnyard grass, flatsedge and Jungle rice during the two growing seasons, except number of barnyard grass in the second seasons, dry weight of barnyard grass in the first season, number of Jungle rice in the first season and dry weight of Jungle rice in the second season.

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2- Rice characters:

2.1- Soil amendments effects:

Data in Tables 4 and 5 cleared that soil amendment treatments showed significant effect on all studied characters in both seasons. As seen from obtained results, the application of farmyard manure at the rate of 10 t/fed as a soil amendment produced the highest values of these characters in the two growing seasons. It was followed by application of sulphur at the rate of 150 kg/fed with concern of flag leaf area and plant height, and application of gypsum at the rate 5.0 t/fed with regard other characters in both seasons. Overall, all soil amendments under study significantly enhanced growth grain and straw yields as well as its components in both seasons. Hence, the lowest means of all studied characters were resulted from control treatment (without soil amendments) in the two growing seasons. This favorable effect of soil amendments especially organic in origin (FYM) may be due to its role in decreasing soil pH, which resulted in increasing solubility of nutrients and nutrient availability to the plants, increase soil organic matter content and offer many benefits as well as contain plant nutrients and act as organic fertilizers. So that enhancement rice growth and development as well as its yields. These results are in harmony with those obtained by Chhabra (1999), Rasool *et al.* (2007), Yasmin *et al.* (2007), Ming-gang *et al.* (2008), Bi *et al.* (2009) and Masulili (2010).

2.2- Weed control treatments effects:

As shown from data in Tables 4 and 5 the studied weed control treatments significantly affected rice growth, grain and straw yields as well as its components in the two growing seasons. Application of bispyribac sodium in controlling weeds in rice fields significantly surpassed other weed control treatment and produced the highest values of studied rice characters in both seasons. It was followed by using thiobencarb in the first season or bensulfuron ethyl in the second season with respect to grain and straw yields. Hand weeding rice weeds twice after 25 and 40 days from sowing recorded the lowest values of all studied characters. The increases in grain yield as a results of using bispyribac sodium, bensulfuron ethyl, thiobencarb, and bentazone were about 107.44, 95.98, 93.03 and 63.53 % as compared with hand weeding over both growing seasons. These results may be due to hand weeding is much more difficult and slower in direct-seeded rice because of high weeds density and similarity between rice and grass weed seedlings. In addition, weed removal by using selective herbicides to dominant weeds when rice plant is still in the early vegetative phase allows more time for the rice plant to maximize use of resources available after removing the weeds, consequently increasing rice productivity. These results are in good accordance with those reported by Palis *et al.* (1999), Moshtohry (2001), Abd El-Wahed *et al.* (2003), El-Desoki (2003), Shalaby (2005) and Ebaid and Shebl (2006).

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All rice characters *i.e.* flag leaf area, plant height, number of panicles/m^2, panicle length, number of grains/panicle, 1000- grain weight, grain and straw yields/fed significantly affected by the interaction between both studied factors in both seasons. We have reported enough the interactions on grain yield only. As seems to appear from data in Table 6, the highest values of rice grain yield were obtained when application FYM at the rate of 10 t/fed as a soil amendments and using bispyribac sodium in order to control spread weeds in rice field in both seasons of this study. However, application gypsum at the rate of 5.0 t/fed and also bispyribac sodium came in the second rank in both seasons. Control treatment of both factors (without soil amendments and hand weeding) recorded the lowest values of rice grain yield in the two growing seasons.

Table 6: Grain yield (t/fed) of rice as affected by the interaction between soil amendments and weed control during 2007 and 2008 seasons.

Weed control / Soil amendments	Hand weeding	Saturn 50 % EC	Basagran 48 % AS	Nominee 2 % SL	Sirius 10 % WP
2007 Season					
Without (control)	2.210	4.070	3.883	4.430	4.270
Gypsum at 2.5 t/fed	2.573	4.950	3.790	5.163	4.802
Gypsum at 5.0 t/fed	2.790	5.080	4.540	5.595	5.143
Farmyard manure at 5 t/fed	2.450	4.870	3.762	5.110	4.682
Farmyard manure at 10 t/fed	2.890	5.040	4.756	5.630	5.140
Sulphur at 75 kg/fed	2.220	4.790	3.620	5.000	4.713
Sulphur at 150 kg/fed	2.762	5.060	4.540	5.320	5.030
F. test	*				
LSD at 5 %	0.136				
2008 Season					
Without (control)	2.215	4.080	3.864	4.335	4.115
Gypsum at 2.5 t/fed	2.715	5.926	4.533	5.585	5.050
Gypsum at 5.0 t/fed	2.915	5.239	4.781	5.696	5.209
Farmyard manure at 5 t/fed	2.468	4.746	3.847	5.028	4.771
Farmyard manure at 10 t/fed	2.324	4.822	3.826	6.269	6.694
Sulphur at 75 kg/fed	2.184	4.699	3.659	4.892	4.698
Sulphur at 150 kg/fed	2.664	4.924	4.456	5.336	5.017
F. test	*				
LSD at 5 %	0.186				

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تأثير بعض مصلحات التربة ومعاملات مقاومة الحشائش على نمو ومحصول الأرز

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أجريت تجربتان حقليتان بمزرعة خاصة بقرية الأبحر - مركز الحامول - محافظة كفر الشيخ خلال موسمى ٢٠٠٧ و ٢٠٠٨ لدراسة تأثير مصلحات التربة (بدون ، جبس بمعدل ٢,٥ و٥,٠ طن/فدان ، سماد بلدى بمعدل ٥ و١٠ طن/فدان وكبريت بمعدل ٧٥ و١٥٠ كجم/فدان) ومعاملات مقاومة الحشائش (مقاومة يدوية ومبيدات حشائش الأرز ساتيرن ، بازاجران ، نومينى وسيريس) وكذلك التفاعل بينهم على صفات الحشائش والنمو والمحصول ومكوناته للأرز صنف جيزة ١٧٨. أجريت التجارب فى تصميم الشرائح المتعامدة فى أربع مكررات خلال الموسمين.

ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلى:

١- أدى إستخدام السماد البدى بمعدل ١٠ طن/فدان للحصول على أقل عدد ووزن غض وجاف لحشيشة الدنيبة وأعلى القيم لصفات النمو والمحصول ومكوناته للأرز خلال موسمى الدراسة. أما أقل القيم لعدد ووزن غض وجاف لحشيشة العجيرة فقد نتجت من معاملة الجبس بمعدل ٥ طن/فدان فى الموسم الأول والكبريت بمعدل ١٥٠ كجم/فدان فى الموسم الثانى. فى حين أن إستخدام الجبس بمعدل ٢,٥ طن/فدان قد نتج عنها أقل عدد ووزن غض وجاف لحشيشة أبوركبة فى كلا الموسمين.

٢- أستخدام مبيد النومينى بمعدل ٨٠٠ سم٣/فدان بعد ٢٣ يوم من الزراعة أدى للحصول على أقل القيم للعدد والوزن الغض والجاف لحشيشتى الدنيبة وأبوركبة وأعلى القيم لصفات النمو والمحصول ومكوناته للأرز خلال موسمى الدراسة. فى حين أن إستخدام مبيد الساتيرن بمعدل ٢ لتر/فدان بعد ٩ أيام من الزراعة أدى للحصول على أقل القيم للعدد والوزن الغض والجاف لحشيشة العجيرة فى فى كلا الموسمين.

٣- كان للتفاعل بين مصلحات التربة ومعاملات مقاومة الحشائش تأثيراً معنوياً على جميع الصفات تحت الدراسة للحشائش والأرز فيما عدا عدد حشيشة الدنيبة فى الموسم الثانى ، الوزن الجاف لحشيشة الدنيبة فى الموسم الأول ، عدد حشيشة أبوركبة فى الموسم الأول والوزن الجاف لحشيشة أبوركبة فى الموسم الثانى.

من النتائج المتحصل عليها فى هذه الدراسة يوصى بإستخدام السماد البلدى بمعدل ١٠ طن/فدان أو الجبس بمعدل ٥ طن/فدان ومقاومة الحشائش بإستخدام مبيد النومينى للحصول على أعلى إنتاجية للأرز تحت ظروف منطقة الحامول - محافظة كفر الشيخ.

قام بتحكيم البحث

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Table 3: Number, fresh and dry weights of barnyard grass (*Echinochloa crus – galli* (L.) Beaur), flatsedge (*Cyperus difformis* L.) and Jungle rice (*Echinochloa colonum* (L.) Link)/m^2 at 50 DFS as affected by soil amendments and weed control as well as their interactions during 2007 and 2008 seasons.

Characters / Treatments	*Echinochloa crus – galli*						*Cyperus difformis*						*Echinochloa colonum*					
	Number		Fresh weight (g)		Dry weight (g)		Number		Fresh weight (g)		Dry weight (g)		Number		Fresh weight (g)		Dry weight (g)	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
A- Soil amendments:																		
Without (control)	5.50	6.30	**109.84**	**110.69**	16.90	15.07	12.30	12.10	**174.55**	**166.75**	24.38	22.18	3.40	3.75	41.90	46.25	6.06	6.13
Gypsum at 2.5 t/fed	5.75	5.20	**113.52**	**116.05**	16.08	18.33	11.30	12.15	**170.45**	**182.20**	23.70	23.31	3.20	2.55	41.35	44.00	6.05	5.84
Gypsum at 5.0 t/fed	5.55	5.90	**115.74**	**117.41**	17.16	15.75	11.05	12.50	**167.55**	**178.30**	23.31	22.84	3.55	3.00	46.65	45.75	6.82	6.45
Farmyard manure at 5 t/fed	5.25	5.65	**104.13**	**118.80**	15.05	16.19	11.95	11.50	**174.83**	**178.30**	24.44	22.90	3.80	3.30	50.55	48.60	7.12	6.37
Farmyard manure at 10 t/fed	4.75	5.15	**101.97**	**108.65**	14.62	14.60	13.00	14.55	**173.05**	**176.55**	24.10	22.82	4.95	4.30	57.40	51.80	8.31	6.92
Sulphur at 75 kg/fed	5.75	6.10	**118.75**	**133.65**	17.51	17.95	15.25	14.75	**171.85**	**157.60**	23.87	20.37	4.55	4.35	53.40	49.20	7.70	6.67
Sulphur at 150 kg/fed	6.05	6.20	**116.54**	**115.10**	16.76	15.73	13.30	10.70	**169.60**	**148.15**	23.52	18.82	3.70	4.10	50.20	56.20	7.10	7.46
F. test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.50	0.67	8.48	9.64	1.23	1.61	0.83	0.82	1.99	2.59	0.75	0.77	0.51	0.93	3.05	3.49	1.53	1.37
B- Weed control:																		
Hand weeding (control)	12.28	11.57	**268.63**	**264.10**	43.48	39.41	20.46	19.28	**302.42**	**280.96**	48.38	42.68	7.64	7.42	**109.96**	**114.82**	17.59	16.89
Saturn 50 % EC	3.46	4.46	**61.86**	**66.94**	6.95	7.46	5.07	6.10	**66.91**	**68.42**	6.69	6.15	2.28	2.35	25.50	27.07	3.05	3.27
Basagran 48 % AS	7.57	7.92	**152.57**	**163.39**	22.04	20.92	10.92	10.75	**136.14**	**139.03**	16.33	15.27	4.78	4.32	58.07	54.75	8.28	7.10
Nominee 2 % SL	0.50	0.67	**8.07**	**9.45**	0.79	3.50	15.57	15.67	**223.03**	**217.57**	31.22	28.28	1.07	0.82	11.25	11.17	1.12	1.15
Sirius 10 % WP	3.75	4.28	**66.35**	**82.07**	8.21	9.86	10.92	11.21	**129.96**	**142.46**	16.89	17.08	3.60	3.17	39.10	36.32	5.08	4.32
F. test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	1.74	2.03	22.56	24.65	3.23	3.44	1.00	0.98	4.14	5.43	0.92	1.05	1.56	2.44	8.20	9.23	7.52	8.19
C- Interaction:																		
	*	NS	*	*	NS	*	*	*	*	*	*	*	NS	*	*	*	*	NS

Table 4: Flag leaf area, plant height, number of panicales/m^2 and panicle length of rice as affected by soil amendments and weed control as well as their interactions during 2007 and 2008 seasons.

Characters / Treatments	Flag leaf area (cm^2)		Plant height (cm)		Number of panicales/m^2		Panicle length (cm)	
	2007	2008	2007	2008	2007	2008	2007	2008
A- Soil amendments:								
Without (control)	15.19	15.28	83.01	82.79	289.5	281.0	16.82	16.90
Gypsum at 2.5 t/fed	16.43	16.34	85.66	85.28	389.4	397.6	17.61	17.67
Gypsum at 5.0 t/fed	17.44	17.43	87.45	86.86	427.6	429.1	18.61	18.43
Farmyard manure at 5 t/fed	17.01	16.99	86.90	86.61	386.9	394.3	17.57	17.73
Farmyard manure at 10 t/fed	18.34	18.40	89.41	88.70	431.7	429.3	18.63	18.68
Sulphur at 75 kg/fed	16.29	17.12	86.84	86.27	393.3	393.0	17.29	17.28
Sulphur at 150 kg/fed	17.48	17.54	88.11	87.53	421.7	411.9	18.27	18.33
F. test	*	*	*	*	*	*	*	*
LSD at 5 %	0.45	0.54	1.15	0.97	12.1	12.9	0.18	0.20
B- Weed control:								
Hand weeding (control)	14.25	14.29	77.45	76.72	196.5	200.6	14.43	14.39
Saturn 50 % EC	17.07	17.27	89.29	89.25	430.9	430.6	18.69	18.72
Basagran 48 % AS	16.57	16.72	87.18	86.43	395.4	393.6	17.90	17.87
Nominee 2 % SL	18.65	18.79	90.59	90.48	476.3	478.6	19.49	19.55
Sirius 10 % WP	17.89	17.99	89.34	88.58	458.1	450.8	18.63	18.76
F. test	*	*	*	*	*	*	*	*
LSD at 5 %	0.46	0.40	1.10	1.04	10.2	9.8	0.15	0.15
C- Interaction:								
	*	*	*	*	*	*	*	*

Table 5: Number of grains/panicle, 1000 - grain weight, grain and straw yields per feddan of rice as affected by soil amendments and weed control as well as their interactions during 2007 and 2008 seasons.

Characters / Treatments	Number of grains/panicle		1000 - grain weight (g)		Grain yield (t/fed)		Straw yield (t/fed)	
	2007	2008	2007	2008	2007	2008	2007	2008
A- Soil amendments:								
Without (control)	87.06	86.79	21.05	21.12	3.773	3.722	4.104	4.002
Gypsum at 2.5 t/fed	91.03	93.33	22.15	22.42	4.256	4.762	4.609	4.666
Gypsum at 5.0 t/fed	100.73	101.97	23.51	23.46	4.630	4.768	4.962	4.984
Farmyard manure at 5 t/fed	91.71	93.29	22.13	22.59	4.175	4.172	4.522	4.727
Farmyard manure at 10 t/fed	101.79	102.56	23.56	23.65	4.691	4.787	5.038	5.142
Sulphur at 75 kg/fed	92.39	93.11	21.29	22.36	4.069	4.026	4.386	4.538
Sulphur at 150 kg/fed	98.72	97.81	23.45	23.23	4.542	4.479	4.860	4.886
F. test	*	*	*	*	*	*	*	*
LSD at 5 %	3.50	3.10	0.53	0.56	0.116	0.156	0.112	0.084
B- Weed control:								
Hand weeding (control)	75.31	75.75	17.32	17.31	2.556	2.498	2.886	3.004
Saturn 50 % EC	95.84	96.85	24.09	24.45	4.837	4.919	5.193	5.222
Basagran 48 % AS	91.18	89.80	23.10	22.91	4.127	4.138	4.480	4.570
Nominee 2 % SL	114.43	116.73	24.78	25.06	5.178	5.306	5.521	5.491
Sirius 10 % WP	97.12	98.61	22.95	23.72	4.826	5.079	5.120	5.244
F. test	*	*	*	*	*	*	*	*
LSD at 5 %	3.46	2.83	0.63	0.55	0.157	0.142	0.161	0.090
C- Interaction:								
	*	*	*	*	*	*	*	*