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WEEDING STAGES AND THEIR EFFECT ON YIELD AND YIELD COMPONENTS OF RICE IN UPPER SWAT-PAKISTAN

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ABSTRACT

To study the effect of different weeding levels and stages on growth, paddy yield and yield contributing components of coarse rice, a field experiment was conducted at Agricultural Research Institute (ARI-North) Mingora (Swat) Pakistan during kharif season 2013. Experimental design used was Randomized Complete Block Design (RCBD) with four replications. The experiment consisted of seven treatments namely no weeding (T1), one stage weeding (Transplanting to flowering) (T2), one stage weeding (Flowering to panicle setting) (T3), one stage weeding (Panicle setting to maturity) (T4), two stage weeding (Transplanting to flowering and Flowering to panicle setting) (T5), two stage weeding (Flowering to panicle setting and Panicle setting to maturity) (T6), and three stage weeding (Transplanting to flowering, Flowering to panicle setting and Panicle setting to maturity) (T7). Weeds density significantly influenced all the agronomic traits of the rice plant. Minimum weeds per unit area in all growth stages were observed with T6 and T7. It was observed from the results that T6 and T7 reduced weeds population in all the growing period of rice crop. Yield components such as number of tillers were improved and showed best performance (20.84) with T_2 on one stage weeding (Transplanting- flowering) that was at par (21.20) with T_7 at three stage weeding (transplanting to flowering, flowering to panicle setting and panicle setting to maturity). Three stage weeding (transplanting - flowering, flowering – panicle setting and panicle setting – maturity) make sure that maximum panicle length (21.83cm), highest paddies panicle^{-} (183.7), highest 1000 paddy weight (20.31g) and highest paddy yield (4196 kg ha^{-1}) was recorded as compared to other weeding stages. Among weeding stages minimum paddies panicle^{-1}(147.25), panicle length (15.67 cm) and 1000 paddies yield (16.32 g) was observed in one stage weeding (transplanting to flowering) followed by one stage weeding (flowering to panicle setting). Lowest tillers, paddies panicle^{-1}, panicle length, 1000 paddy weight and paddy yield was noted in no weeding. These components highly affected yield and yield contributing parameters of rice.

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INTRODUCTION

Rice (*Oryza sativa* L*)* is a major *kharif* crop of Pakistan after wheat and ranking 2nd as a staple food. Rice cultivation gradually moved and taken a predominant position in Pakistan Agricultural economy (Imran *et al*., 2015).

It is the main food items of more than 3.5 billons people in Asia Subcontinent. Population in the world is increases and land resources are decreases day by day. Therefore rapid increase in population will required 70% more rice production in 2025 than those of today production (Kim and Krishnan, 2002). Rice is presently cultivated on 2.25 million hectares and is the 3rd largest crop after wheat and maize in term of area. Cultivation of rice traditionally concentrated in central Punjab, North West district of Sindh and in the Khyber Pakhtunkhwa (Imran *et al.*, 2015). It is the main source of economy development, prosperity and income of the rice growing belts of the rural areas (Bashir *et al*., 2010). Rice is grown in two different climatic conditions in Khyber Pakhtunkhwa i.e. Upper mountainous valleys (uplands) and the plains. Total area under rice cultivation in Khyber Pakhtunkhwa is 64719 hectares in which 81% is situated in high altitudes, Cooler areas of Hazara and Malakand divisions and adjacent Trible areas (NWFP agriculture statistics 2007-2008).The average Paddy production in country and particularly in Khyber Pakhtunkhwa is very low and far behind from the potential of the crop. This might be due to many reasons. Although it is possible to enhance paddy yield many folds by adopting new scientific findings and advance agricultural technologies. By adopting scientific agricultural technologies it may reduce production cost and increase the net profit of the growers and ultimately improve the socio-economic condition of the growers (Hussain *et al*., 2005).The production of rice in Khyber Pakhtunkhwa is very low and especially in district Swat. There are so many reasons of the low yield but one of the most important reasons is maximum number of weeds (Bashir *et al*., 2010). Weeds reduce optimum plant population per unit area and an important factor which reduce 30 to 70% yield of the economic crop. Rice is a very competitive crop against the weeds and therefore essential to control weeds population and their dissemination (Imran et al, 2015). The competition between economic crop and weeds occurred for nutrients, water, light and for space (Akter *et al*., 2013). It is also reported that many weeds

population provide foods, shelter and habitat for a range of insect, pest which disseminates the diseases (Lu and Cai, 2000). Weeds crop competition with rice crop starting after transplanting and continue till maturity. Vigorous growth stages of rice such as tillering, flowering, panicle setting are greatly influenced by weeds and infestation by weeds in these stages causes low tillering, panicle length, paddies per panicle and ultimately reduced the yield (Akter *et al*., 2013).To obtained maximum rice yield timely control of weeds should be essential. Proper weeds management is the main concern for high yield of rice (Akter *et al*., 2013). Rice is cultivated in many parts of the district swat and very little work has been conducted regarding weeds control and proper management and their effect on paddy yield and yield contributing parameters (Imran *et al*., 2015). In the light of above views and concerns contemporary study was conducted to evaluate the influence of weeding levels and stages on paddy yield and contributing characteristics of yield.

MATERIALS AND METHOD

To evaluate the influence of different weeding levels and stages on yield and yield components of rice, field experiment was conducted at Agricultural Research Institute (North), (ARI-N) Mingora (Swat) Pakistan during Kharif season 2013. Experimental design was used Randomized Complete Block Design (RCBD) with four replications. There were three weeding stages. One stage weeding (T-F), (F-P) and (P-M), Two stages weeding (T-P) and (F-M) and three stages weeding (T-M), from Transplanting to Flowering (T-F), Flowering to Panicle setting (F-P) and Panicle setting to Maturity (P-M) and rice genotype Fakhr-e-Malakand was used.

Treatment	Transplanting	Flowering	Panicle setting	Maturity
T1(no weeding)				
T2 (T-F)	//////////			
T3 (F-P)		//////////		
T4 (P-M)			//////////	
T5 (T-F-P)	//////////	//////////		
T6 (F-P-M)		//////////	//////////	
T7 (T-F-P-M)	//////////	//////////	//////////	//////////

T = Transplanting, F = Flowering, P = Panicle setting, M = Maturity

Rice nursery was grown on dry bed method. Seedling germination was vigorous and was above 90%. Seedling reached to its optimum height in 30 days and was ready for transplantation. The field was well prepared and puddled. Experimental plots were allocated in uniform size of 10 meters in length and 3 meters in width. Optimum row to row and plant to plant distance was kept 20x20 cm. The

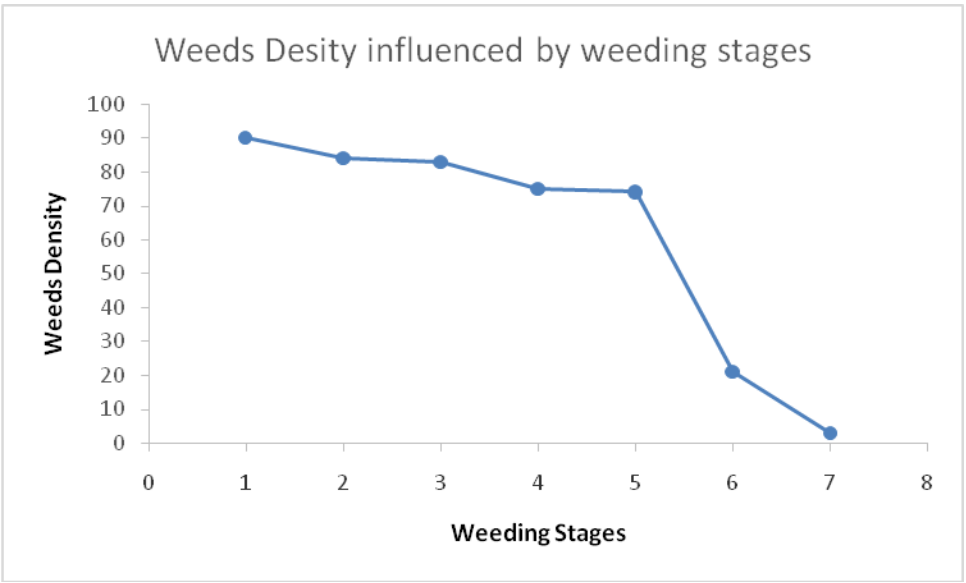
genotype Fakhr-e-Malakand was transplanted in six rows with four replications. Each row was consisted on 15 plants. All the recommended agronomic practices were followed. The following parameters were studied and data were recorded on tillers plant^{-1}, numbers of paddy panicle^{-1},panicle length (cm), 1000 paddy weight and paddy yield (kg ha^{-1}). Tillers were counted in five randomly selected plants at physiological maturity and then averaged. Paddies panicle^{-1}was counted in each sub plots after harvesting. Five plants were randomly selected; paddies were counted and then averaged. After threshing, thousand paddies were taken from bulk of each sub plot and weighted with the help of electronic balance. Total paddy yield of each plot was recorded with the help of electronic balance after threshing and then converted into kg ha^{-1}.

Collected data were analyzed statistically according to the procedure relevant to RCB design. Upon significant F-Test, least significance difference (LSD) test was used for mean comparison to identify the significant components of the treatment means (Jan *et al.*, 2009).

RESULTS AND DISCUSSION

Weeds density after 25 days of transplanting (m^{-2})

Perusal of the data regarding weed density after 25 days of transplanting (ADT) showed that weeds density significantly influenced Paddy yield and other contributing parameters. Maximum weeds m^{-2} was recorded 25 DAT (84 m^{-2}). Lowest weed density m^{-2} was recorded after one stage weeding (T-F). This might be due to appropriate time of transplanting to provide optimum requirements for weeds emergence with the application of essential plant nutrients which frequently, and competitively get by weeds as compared to economic crop which provides luxurious growth to weeds as compared to the other crop (Khan et al., 2015 and Imran and Khan., 2015). Two stage weeding suppressed the weeds due to before of its optimum time for growth and development. As the level of weeding stages increased a linear decrease was recorded in weeds density. This might be due to increase in weeding and elimination of the weeds which disturbed the growth cycle of the weeds plant and might be due to vigorous growth stage of the economic crop which have well established root system which utilize maximum nutrients for their growth, maintenance and survival and become dominant on weeds in respect of growth and other contributing parameters (Imran, 2015; Khan *et al.*, 2015; Arif *et al.*, 2012). The reason could be due to highest tillering numbers of the rice plant at that stage which decreases the competition of weeds with economic crops through there shading and occupying of space which leads the economic crop dominant over the weeds (Arif *et al.*, 2012).



Number of tillers plant^{-1}

Weeding stages significantly affected number of tillers plant^{-1}. Maximum tillers plant^{-1} was recorded in T_7 (21.20) where three stages of weeding was treated from Transplanting to Maturity (T-M) and at par value tillers having non statistical difference were noted in T_2 (20.84) where one stage weeding was done from Transplanting to Flowering (T-F). Minimum tillers plant^{-1} (12) was observed in $T_1$where no weeding was treated from Transplanting to Maturity (T-M). Two stage weeding in $T_5$from Transplanting to Flowering and Flowering to Panicle setting (T-P) produced more tillers (19.91) after T_7 three stage weeding (T-M) and T_2one stage (T-F) weeding followed by T_3 (16.20) one stage weeding (F-P) followed byat par value T_4one stage weeding (P-M) andT_6two stage weeding from flowering to Panicle setting and to Maturity (F-M) having non statistical difference (14.13 & 14.76). The findings of the results indicated that number of tillers significantly increased with increase in weeding numbers and proper time of weeding in growth stages. This might be due to competition between weeds and economic plant for nutrients, water, air and space and a result population per unit area are reduced. Crop growth and yield are determined by weeds control, optimum crop stand and proper weeds management. These two determinants directly or indirectly affected yield (Imran et al., 2015 and Arif *et al.*, 2012).This occurrences are supported by Akter *et al.*, (2013) they reported that growth and yield

of mungbean significantly increased with weeding time and days after sowing.

Panicle length (cm)

Perusal of the data indicated that panicle length significantly increased with increase in weeding stages intensity. Result indicated that highest panicle length (21.83 cm) was produced by T_7 three stage weeding (T-M) followed by T_5 (19.42 cm) two stage weeding (T-P) where weeding was carried from Transplanting to flowering and flowering to panicle setting. Minimum panicle length (14.31 cm) was noted in T_1 where no weeding was carried from Transplanting to Maturity. Weeding intensity at various stages enhanced panicle length. One stage weeding T_3 (F-P) and T_4 (P-M) produced at par value panicle length (16.93 and 16.41 cm) followed by T_2 (T-F) having 15.67 cm panicle length. Increase in panicle length due to various weeding stages might be due to frequently nutrients uptake, water absorption and optimum plant population per unit area. Weeds compete with economic plants for growth, maintenance and their survival and as a result effect the growth, yield and yield contributing parameters of the economic plant. These findings of the results are with conformity with those of Khan et al. (2015) and Akter *et al*. (2013). They reported that pods length was affected with weeding in mungbean. Vigorous growth and potential yield are influenced by proper crop stands, weeds control, and proper weeds management. These two determinants directly or indirectly affected yield (Arif *et al*., 2012; Imran and Khan, 2015).

Paddy panicle^{-1}

Data regarding paddies panicle^{-1} are presented in Table-1. Analysis of the data divulge that highest number of paddies (183.7) were counted in T_7 three stages weeding (T-M) where weeding was treated from transplanting to maturity followed by at par value two stages weeding T_5 (T-P) and T_6 (F-M) produced (167.84 and162.91) non statistically different paddies panicle^{-1} respectively. Minimum paddies panicle^{-1} (128.93) was recorded in T_1 where no weeding was treated from transplanting to maturity. In one stage weeding, T_3 (F-P) produced 152.72 paddies panicle^{-1} followed by T_2 (T-F) and T_4 (P-M) where weeding was carried from Transplanting to Flowering in T_2 and from Panicle setting to Maturity in T_4 produced 147.25 and 140.71 paddies respectively. Variation among number of paddies panicle^{-1} might be due to weeds and rice plant competition in rhizosphere for searching of water, nutrients uptake, ions exchange, and volume occupied by the roots. Which effect the plant growth, yield and yield contributing parameters. Weeding levels increase light perception and ultimately plant receive more light which enhance photosynthesis and activity of vascular tissue. Ultimately paddies panicle^{-1} increased.

Thousand paddy weight (g)

Weeding stages level significantly affected 1000 paddy weight. Statistical analysis and perusal of the data showed that maximum 1000 paddy weight (20.31 g) was obtained from three stages weeding T_7 where weeding was carried from Transplanting to Maturity (T-M) followed by two stages weeding $T_6$where weeding was treated from flowering to maturity (F-M) produced (18.94g) 1000 paddy weight. Minimum 1000 paddy weight (15.72 g) was recorded in T_1 where no weeding was treated from transplanting to Maturity leading by two stage weeding T_5 where weeding was carried from transplanting to flowering and from flowering to panicle setting (T-P) obtained 17.84 g paddy weight. Paddy weight increased with increase in weeding levels. Maximum weeding helped the economic plant for optimum seed filling and development.

In T_1 where no weeding was treated from transplanting to maturity lower assimilation of photosynthesis produce and translocation towards sink and reproductive organs was inhibited by maximum weeds present per unit area. The observation was noted in different weeding levels. These results are supported by Akter *et al.*, (2013) they concluded from their experiment that all yield contributing parameters significantly influenced by weeding levels.

Paddy yield (kg ha^{-1})

Table-1 consists on data regarding paddy yield. The perusal and analysis of the data indicated that paddy yield significantly affected by all stages of weeding levels. Mean data revealed that maximum paddy yield (4196 kg) was observed in $T_7$where three stage weeding was treated from transplanting to maturity (T-M) followed by two stage weeding levels produced (3670 and 3584 kg) at par value paddy yield in T_5(T-P) and T_6(F-M). Minimum paddy yield (2947 kg) was recorded in $T_1$where no weeding was done from transplanting to maturity (T-M). Weeding enhanced paddy yield even on one weeding stage. A significant difference was found between weeding and non-weeding plots. One stage weeding T_2 (T-F) and T_3 (F-P) produced at par value paddy yield (3372 and 3435 kg ha^{-1}) having non statistical difference. Paddy yield increased 42.38% in weeding treated plot as compared to non-weeding treated plots. Weeding levels increase light perception, increase assimilates production, photosynthesis and translocation of photosynthates to reproductive units, more nutrients availability, water absorption and ultimately plant enhance activity of vascular tissue and as a result paddies yield increased.

Table-1. Weeds density after 25 days of transplanting (WD), number of tillers plant^{-1}(TPP), panicle length (PL), paddy panicle^{-1} (PPP), thousand paddy weight (TPW) and paddy yield (PY) of rice as affected by weeding stages

Treatment	WD	TPP	PL (cm)	PPP	TPW (g)	PY (kg ha^{-1})
T1 (no weeding)	90cd	12.43e	14.31f	128.93f	15.72e	2947e
T2 (T-F)	84c	20.84a	15.67e	147.25d	16.32ed	3372c
T3 (F-P)	83c	16.20c	16.93d	152.72c	16.84d	3435c
T4 (P-M)	75c	14.13d	16.41d	140.71e	16.91d	3152d
T5 (T-P)	74c	19.91b	19.47b	167.84b	17.84c	3670b
T6 (F-M)	21b	14.76d	18.62c	162.91b	18.94b	3584b
T7 (T-M)	03a	21.20a	21.83a	183.70a	20.31a	4196a
LSD $_{(0.05)}$	14	0.72	0.51	5.37	0.67	135

NS = non-significant; Means in the same category followed by different letters are significantly differentat P ≤0.05 level

CONCLUSION

From present study, it was concluded that rice genotype Fakhr-e-Malakand was found very sensitive to weeds competition. Weeds density greatly reduced paddy yield in control plot as compared to weeding treated plot. Paddy yield positively responded to weeds density and weeding stages. and gave significantly higher tiller plant^{-1}, panicle length, paddies panicle^{-1}, thousand paddy weight and paddy yield in T_7, three stages weeding in the three different growth stages from Transplanting to Flowering (T-F), Flowering to Panicle setting (F-P) and Panicle setting to Maturity (P-M) where weeding was treated from Transplanting to Maturity(T-M).

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