Standing Crop Structure and Production of Paddy Crop (*Oryza sativa*) Under Weed Free and Weed Infested Conditions

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ABSTRACT

In the study on biomass structure and production pattern of paddy crop growing in weed infested and weed free conditions, the above ground biomass structure revealed a steady linear upward trend with a decline recorded after 15 days of sowing and at harvest. However, the production values fluctuated during various stages of crop growth. It registered a decline during 3rd week but recovered significantly until harvest where again a decline was recorded. The biomass values under weed free condition registered a peak value of 2087.67 g/m^2 while as under weed infested condition a maximum value of 1886.34 g/m^2 was recorded after 78 days of sowing. The production pattern registered a peak value of 619.97 g/m^2/week in weed free plot and 512.46 g/m^2/week in weed-infested plot during 11th week of transplantation.

Key words: Standing crop, above ground production, weeds, paddy fields

INTRODUCTION

The rice field ecosystems provide habitat to a rich composition of primary producers. With the dominance of rice crop monoculture, grasses, sedges and broad leaved plants generally referred to as weeds are also abundant (Bambaradeniya *et al.*, 2003). As a consequence of heavy competition offered by weed associations, crop plants get only limited space to develop their shoot system which effects their photosynthetic activity adversely (Mandal, 2000). In this comparative investigation, the impact of competition between transplanted rice and weeds on biomass and production of rice crop was the main objective. With the same background a field experiment was designed and carried out in the rice field of Bandipora village situated on the eastern bank of Wular lake. Two field plots measuring 100 m^2 were maintained as per the local cultivation practices (N P K,120,40,30 kg/ha) except that one of the plots was maintained weed free by the application of weedicide (Butachlor) while another plot was left as such and no weedicide was used which resulted in profuse growth of weeds. Both the plots being adjacent to each other were fed by the same irrigation canal. The paper thus presents a comparative and critical investigation in which the impact of competition between transplanted rice and weeds on biomass and production of rice crop was the main objective.

MATERIAL AND METHODS

In order to achieve the objectives of proposed study, two experimental plots measuring 100m^2 each were demarcated, after proper identification in the lush green paddy fields of Bandipora village 62 km to the north of Srinagar city. Normal irrigation and fertilizer practices were adopted in both the plots. Phosphorus and potassium were applied uniformly as basal dose at the rate of 40 kg P_2O_5 and 30 kg K_2O per hectare respectively. 120 kg/ha of nitrogen in the form of urea was applied in two split doses, half as basal dose and other half after transplantation. Weedicide in the form of Butachlor [2-chloro-2, 6-diethyl-N (butoxymethyl acetanilide)] was applied at the rate of 20 kg/ha in one of the plots whereas in the second plot no weedicide application was made. Both the plots were in receipt of irrigation from the common source viz., Zainageer irrigation canal. The plots being adjacent to each other enjoyed the same meteorological and soil conditions. Standing crop biomass was estimated as per the Harvest method prescribed by Bullock (1997). Every fortnight, 4 quadrats of 50 x 50 cm were laid in a zig-zag manner in each of the plots. The crops from within the quadrats were clipped off using scissors and brought to the laboratory for examination. Fresh weight of the above ground parts was recorded immediately after collection followed by drying in a hot air oven at 105°C so as to obtain constant dry weight. The above grounds parts of crops were separated into vegetative photosynthetic parts, reproductive photosynthetic (green) parts and reproductive non-green parts. The production was calculated from the biomass data using subtraction method following Westlake (1965). It was estimated for above ground parts only and expressed as g/m^2/week.

RESULTS AND DISCUSSION

The present study revealed that the above ground biomass of paddy crop in both weed free and weed infested conditions depicted a linear upward trend throughout the growth phase. However, a temporary decline was registered soon after transplantation and again at the harvesting stage (Fig.1). The accumulation of biomass started immediately after transplantation registering a linear increase *vis-a-vis* crop growth. It showed an increase from the initial values of 159.83g/m^2 in weed free and 139.68g/m^2 in weed infested crops registered after 15 days of transplantation to a peak value of 1036.97g/m^2 in weed free plots and 996.82g/m^2 in weed infested plots recorded after 71 days of transplantation. Although the biomass accumulation in both weed free and weed infested conditions showed a steady increase ,yet a temporary decline in production was recorded during the 4th week after transplantation before the onset of reproductive growth. With the onset of maturity, the photosynthetic vegetative biomass declined to 801.12g/m^2 for weed free crop and 754.29g/m^2 for weed infested crop recorded during 11th week after transplantation (Table 1 and 2). The photosynthetic vegetative biomass disappeared completely at the time of harvest which could be attributed to a decrease in chlorophyll content and moisture content (Dwivedi, 1970). The rate of biomass accumulation seemed to be governed mainly by the

which could be attributed to a decrease in chlorophyll content and moisture content (Dwivedi, 1970). The rate of biomass accumulation seemed to be governed mainly by the age of crops. Fall in the biomass of crop plants with maturity has been reported by Johnston *et al.*, (1969) and Spiertz (1974).

The reproductive photosynthetic biomass started accumulating from the 7th week onwards after transplantation with an initial value of 111.46g/m^2 observed in weed free crop and 80.96g/m^2 recorded in weed infested crop. The increase continued subsequently upto 71 days after crop transplantation. A peak of 307.67 g/m^2 was recorded in weed free and 282.05 g/m^2 in weed infested plot during the 10th week after transplantation. Hence, a difference of 25.62 g/m^2 was recorded between the peak values of reproductive photosynthetic biomass obtained in the weed free and weed infested fields. The vegetative photosynthetic biomass after reaching a peak of 1036.97 g/m^2 in weed free and 996.82 g/m^2 in weed infested crops during the 10th week after transplantation, recorded a fall in the 11th week up to the value of 801.12 g/m^2 in weed free and 754.29 g/m^2 in weed infested plots and disappearing completely at the harvest (Table 1 & 2).

In case of non photosynthetic component, the biomass accumulation of the vegetative parts started from an initial of 63.71g/m^2 in weed free and 42.92 g/m^2 in weed infested crops recorded during the 9th week after transplantation. It increased subsequently with maturity yielding a maximum of 896.58 g/m^2 in weed free and 758.17g/m^2 in weed infested conditions at the time of harvest, thus, depicting a difference of 138.41g/m^2 between the two plots. The non-photosynthetic reproductive biomass accumulation started after attainment of maturity. The initial values 833.30 g/m^2 recorded for weed free plot and 716.43 g/m^2 recorded for weed infested plot in the 11th week culminated in a high of 992.98 g/m^2 in weed free and 886.30 g/m^2 in weed infested field at the time of harvest.

Table 1. Standing crop structure and above ground production of paddy crop under weed free conditions

Crop age (days after transplantation)	Photosynthetic biomass		Non- Photosynthetic biomass		Total above ground biomass g/m^2	Above ground production g/m^2/week
	Vegetative g/m^2	Reproductive g/m^2	Vegetative g/m^2	Reproductive g/m^2		
15	159.83	-	-	-	159.83	+159.83
22	337.29	-	-	-	337.29	+177.46
29	415.38	-	-	-	415.38	+78.09
36	549.67	-	-	-	549.67	+134.29
43	683.29	-	-	-	683.29	+133.62
50	734.99	111.46	-	-	846.45	+163.16
57	821.60	147.15	-	-	968.75	+112.30
64	921.19	232.65	63.71	-	1217.55	+248.80
71	1036.97	307.67	123.06	-	1467.70	+250.15
78	801.12	251.93	201.32	833.30	2087.67	+619.97
At harvest	-	-	896.58	992.98	1889.56	-198.11

As regards the production pattern, wide fluctuations were registered in both weed free and weed infested plots (Fig. 2). The above ground production rate after registering initial increase of 159.83 g/m^2 per week in weed free and 139.68 g/m^2 per week in weed infested plots declined to 78.09 g/m^2/week in weed free and 38.04 g/m^2/week in weed infested plots during the 4th week of transplantation. However, a significant recovery was observed afterwards marked by a rapid accumulation and increase in the production rate beyond 36 days of transplantation, hence depicting a linear trend after maturity upto harvesting stage where negative -198.11 g/m^2/week and -241.87 g/m^2/week were recorded for weed free and weed infested plots respectively. During the reproductive growth phase though a decline was observed, yet it recovered at maturity yielding a rate of 619.97 g/m^2 per week in weed free and 512.46 g/m^2 per week in weed infested crops registered in the 11th week of transplantation.

Since the productivity of agroecosysytems depends to a great extent on the auxiliary

Table 2. Biomass structure and above ground production of paddy crop under weed infested conditions

Crop age (days after transplantation)	Photosynthetic biomass		Non- Photosynthetic biomass		Total above ground biomass g/m^2	Above ground production g/m^2/week
	Vegetative g/m^2	Reproductive g/m^2	Vegetative g/m^2	Reproductive g/m^2		
15	139.68	-	-	-	139.68	+139.68
22	274.89	-	-	-	274.89	+135.21
29	312.93	-	-		312.93	+166.51
43	527.37	-	-	-	527.37	+45.93
50	682.87	80.96	-	-	763.83	+236.46
57	783.31	128.30	-	-	911.61	+147.78
64	884.29	212.50	42.92	-	1139.71	+228.1
71	996.82	282.05	95.01	-	1373.88	+234.17
78	754.29	226.41	189.21	716.43	1886.34	+512.46
At Harvest	-	-	758.17	886.30	1644.47	-241.87

ISSN 0972-5407

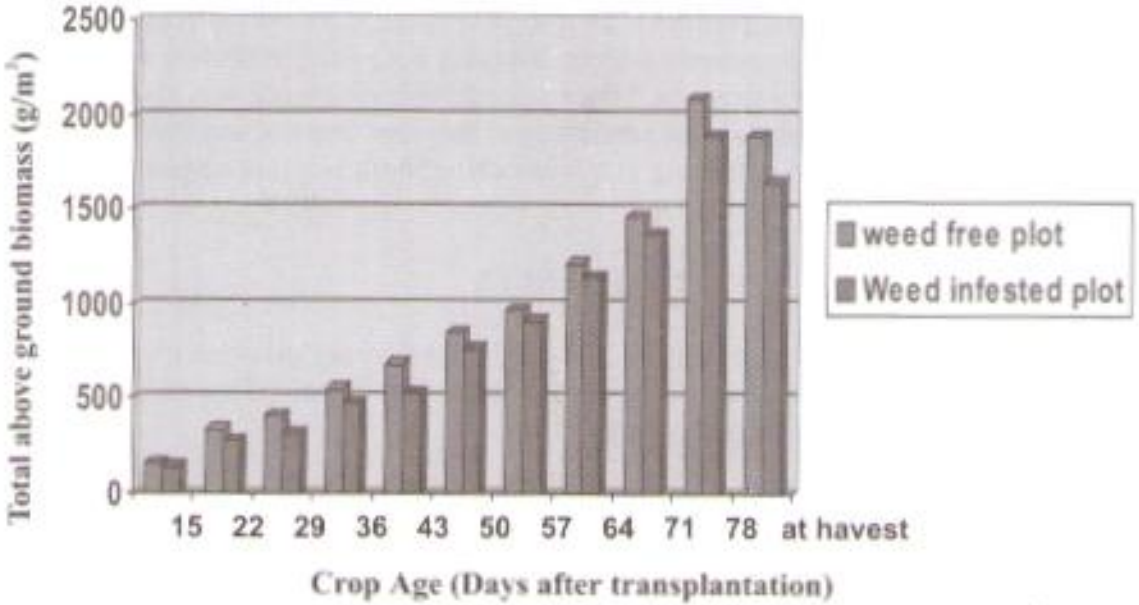

Fig. 1 Standing crops structure of paddy in weed free and weed infested plots

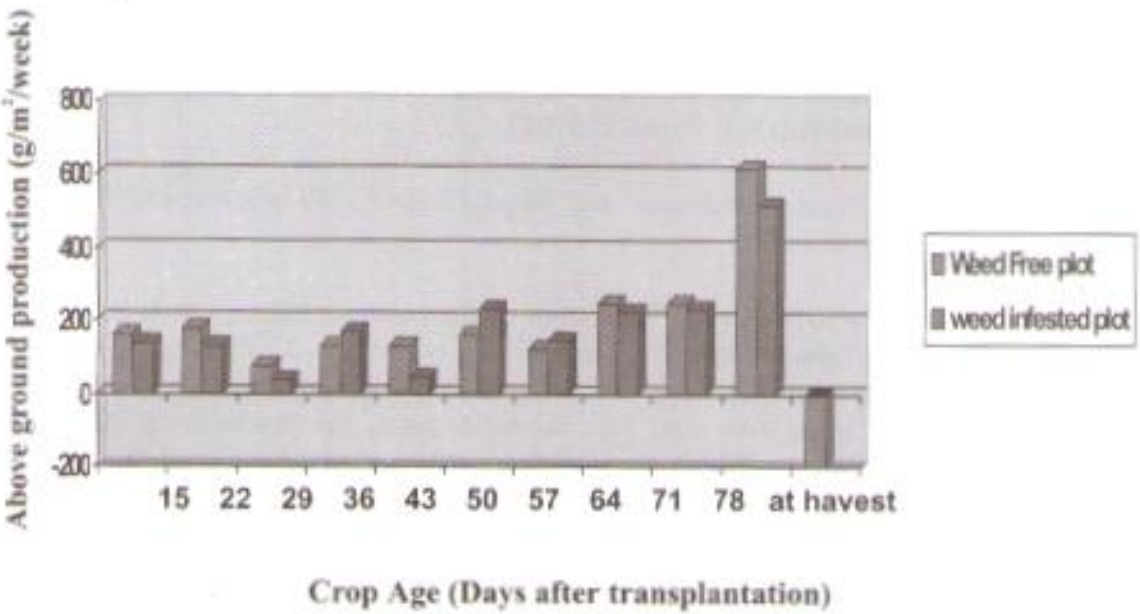

Fig. 2. Above ground production (g/m²/week) of paddy crop in weed free and weed infested plots

energy supplied to the system and the efficiency of various crop systems to utilize it, weeds which constitute an integral components of an agroecosysytem, compete with crop plants for various biotic and abiotic components thereby bringing a significant decline in the yield (Zimdahl,1980). As is evident from the data, a considerable difference was also observed between the biomass accumulation and production of the weed free and weed infested plots with the weed infested crops remaining at a lower ebb of both biomass accumulation and production.

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