Indian Journal of Agronomy **48** (1) : 45–47 (March 2003)

Relationship between main crop stem carbohydrate to ratoon crop yield

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Received : July 2002

ABSTRACT

An experiment was conducted to study the effect of integrated nutrient management practices on performance of main and ratoon crops of hybrid rice (*Oryza sativa* L.) during rainy (*kharif*) and winter (*rabi*) seasons of 1997–98 and 1998–99. In this study, an attempt was made to correlate the carbohydrate concentration in stubbles of main crop at harvest, as influenced by fertilizer-management practices, with ratoon yield. The different fertilizer treatments influenced the sugar and starch content in stubbles significantly during both the years. On an average, the sugar (3.7%) and starch (8.25%) content was maximum in recommended dose of fertilizer (RDF) + sunnhemp treatment. Similarly, the grain yield of main as well as ratoon crops was also maximum with RDF + sunnhemp treatment (7,142 and 2,123 kg/ha). The correlation coefficients between grain yield of ratoon crop and sugar and starch content in stubbles of main crop were also significant and positive.

Key words : Organic manures, Stem carbohydrate and starch, Ratoon crop yield

Rice ratooning is one practical way to increase the rice production per unit area per unit time. But, it is not practised by the farmers in an appreciable area because of low grain yield of ratoon crop. Rapid main crop senescence is assumed to be a major cause of low ratoon rice yields. Senescence or chlorophyll degradation reduces photosynthesis and depletes carbohydrate content. Das and Ahmed (1982) reported that the carbohydrate concentration at harvest of main crop and ratooning ability are closely related. The carbohydrate content in culm at harvest also depends on management practices followed for main crop. Keeping these points in view, an attempt was made to correlate the carbohydrate concentration in stubbles of main crop at harvest, as influenced by fertilizer management practices, with ratoon crop yield.

MATERIALS AND METHODS

A field experiment was conducted at Agricultural Research Station (Paddy), Sirsi, during the rainy (*kharif*) and winter (*rabi*) seasons of 1997–98 and 1998–99. The experiment was laid out in randomized block design, replicated thrice with 7 fertilizer levels (RDF alone, RDF + FYM @ 10 tonnes/ha, RDF + vermicompost, RDF + *Eupatorium*, RDF + *Gliricidia*, RDF + sunnhemp and RDF + paddy straw). The organics, viz. farmyard manure (FYM), vermicompost, *Eupatorium*, *Gliricidia*, sunnhemp and rice straw, were incorporated into the soil 2 weeks before planting. Sunnhemp, *Eupatorium*, *Gliricidia* and rice straw were chopped into small pieces before incorporation. The FYM was applied @ 10 tonnes/ha. The other organics were applied at the quantity to supply the amount of nitrogen contributed by 10 tonnes FYM.

Twenty-five days old seedlings of rice hybrid 'KRH 2' were used in the experiment. Single seedling was planted at each hill. The fertilizers were applied as per the treatments to main crop. The main crop was harvested at a height of 15 cm. The sugar and starch content in stubbles of main crop after harvest was analysed as per the procedure given by Yoshida *et al.* (1976). Yield and yield parameters of ratoon crop as influenced by the treatments imposed for main crop was recorded at harvest.

RESULTS AND DISCUSSION

Effect of fertilizer on planted hybrid rice (main crop)

Application of RDF + sunnhemp recorded significantly higher grain yield (7,142 kg/ha) over RDF alone (5,447 kg/ha) and other treatments having organics along with RDF (Table 1). Among the different treatments, RDF + rice straw recorded significantly lowest grain yield (5,764 kg/ha). The grain yields recorded with RDF + *Eupatorium* (6,709 kg/ha) and RDF + *Gliricidia* (6,764 kg/ha) were at par but significantly superior to RDF + FYM (6,358 kg/ha) and RDF + vermicompost (6,002 kg/ha) (Table 1). Ramteke *et al.* (1998) and Senegar and Srivastava (1998)

Part of the Ph.D. Thesis submitted by the Senior Author to the University of Agricultural Sciences, Dharwad, Karnataka

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Table 1. Grain yield, leaf area at harvest, sugar and starch content in stubbles of main crop as influenced by fertilizers levels and their residual effect on ratoon crop yield and yield parameters (pooled data of 1997–98 and 1998–99)

Treatment	Parameter of main crop				Parameter of ratoon crop			
	Grain yield (kg/ha)	Leaf area/ plant (cm^2)	Sugar content(%)	Starch content(%)	Grain yield (kg/ha)	Panicles/ m^2	Grain weight/ panicle (g)	Grain filling (%)
RDF alone	5,447^{f}	282^{c}	2.30^{c}	6.65^{d}	1,206^{e}	113^{e}	1.05^{d}	69.9^{c}
RDF + FYM (10 tonnes/ha)	6,358^{c}	314^{bc}	2.55^{c}	7.12^{c}	1,511^{d}	121^{d}	1.25^{b}	75.4^{a}
RDF + vermicompost	6,002^{d}	282^{c}	2.40^{c}	7.08^{c}	1,457^{d}	120de	1.15^{c}	70.2^{e}
RDF + *Eupatorium*	6,709^{b}	384^{ab}	3.35^{b}	7.73^{b}	1,630^{e}	130^{c}	1.38^{a}	72.2^{b}
RDF + *Gliricidia*	6,764^{b}	380^{ab}	3.20^{c}	7.82^{b}	1,608^{e}	141^{b}	1.42^{a}	72.5^{b}
RDF + sunnhemp	7,142^{a}	424^{a}	3.70^{a}	8.25^{a}	2,123^{a}	152^{a}	1.41^{a}	75.8^{a}
RDF + rice straw	5,764^{e}	368^{ab}	3.40^{b}	8.02^{ab}	1,790^{b}	138^{b}	1.38^{a}	75.3^{a}
LSD	116	66	0.253	0.294	95.8	6.21	0.07	1.77

RDF, Recommended dose of fertilizers; FYM, farmyard manure
Means followed by same letters in a column are not differing significantly

reported increase in grain yield owing to conjunctive use of organic and inorganic fertilizers compared to inorganic fertilizers.

Sugar and starch content in stubbles of main crop

The fertilizer treatments influenced the pooled sugar content in stubbles significantly. Application of RDF + sunnhemp (3.7%) resulted in greater accumulation of sugar in stubbles compared with the other treatments. The lowest sugar content was recorded with RDF alone (2.3%) and was on a par with that of RDF + FYM (2.55%) and RDF + vermicompost (3.40%). The sugar content recorded with RDF + rice straw (3.4%), RDF + *Eupatorium* (3.35%) and RDF + *Gliricidia* (3.2%) were found at par (Table 1).

Effect of fertilizer of main crop on grain yield of ratoon crop

The fertilizer levels of main crop affected the grain yield of ratoon crop significantly. On an average, application of RDF + sunnhemp to main crop resulted in higher grain yield (2,123 kg/ha), followed by RDF + rice straw (1,845 kg/ha) and differed significantly from one another (Table 1). The increase in grain yield with RDF + sunnhemp and RDF + rice straw was 76.6 and 53.5%, respectively, over RDF alone. The yield parameters, viz. panicles/m^2 (152) and grain filling (75.8%) were also significantly higher with RDF + sunnhemp treatment. The other organics, viz. FYM (1,511 kg/ha), *Eupatorium* (1,631 kg/ha) and *Gliricidia* (1,551 kg/ha) applied along with RDF to main crop also gave significantly higher grain yield than RDF alone and were found at par with each other. The increase in grain yield with these treatments over RDF alone was 25.7, 35.7 and 29.0% respectively. These results indicate that organics applied along with RDF to main crop have better residual effect on succeeding ratoon crop.

Relationship between carbohydrate content in stubbles of main crop and grain yield of ratoon crop

Sugar and starch content in stubbles of main crop (Table 1) showed that the accumulation of sugar and starch was more in organics applied plots compared to RDF alone treatment. This might have induced more vigorous regeneration of ratoon tillers resulting in higher grain yield. Chauhan *et al.* (1985) reported that rapid main crop leaf senesence reduces photosynthesis and depletes carbohydrates. Therefore, if main crop leaf senescence could be delayed, ratoon yield potential may be considerably increased. In the present investigation, the leaf area at harvest of main crop (Table 1) was lowest in RDF alone treatment compared to other treatments having organics in addition to RDF, which shows the rapid leaf senescence in RDF alone. This might have resulted in lesser accumulation of sugar and starch in stubbles of main crop in RDF alone treatment. The higher leaf area in treatments having organics helped in accumulation of more sugar and starch in stubbles of main crop (Table 1). These results are in conformity with those of Jiang *et al.* (1995).

The ratoon crop yield showed significantly positive correlation with sugar and starch content of main crop at harvest. This indicates that increasing sugar and starch levels at main crop maturity increased ratoon crop yields and 74 to 86% of the ratoon crop yield variability can be attributed to sugar and starch content in stubbles of main crop at havest.

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