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ASSIMILATION OF $^{14}CO_2$ IN RICE PLANTS WITH AND WITHOUT NITROGEN APPLICATION

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Abstract

Nitrogen concentration increased in the shoot of young rice seedlings fed with N^{15} and $^{14}CO_2$ but it decreased in N-starved roots. The assimilation of $^{14}CO_2$ was limited in N-starved plants compared to N-fertilized plants.

Introduction

The relationship between carbon and nitrogen in the growth and nutrition of plants needs no emphasis. One of the important functions of nitrogen is to promote the assimilation of carbon in photosynthesis. The deficiency of nitrogen retards chlorophyll formation which in turn limits photosynthesis thus decreasing the accumulation of carbohydrates.An imbalance of C/N ratio upsets the physiological processes in crop plants. An experiment was therefore set up to study the effect of age of rice seedlings (cv. Habi-6) grown with and without nitrogen application on the assimilation of carbon.

Materials and Methods

N^{15} enriched ammonium sulphate (200mg N) was used as N-source in nutrient solution. Rice plants were grown in full strength Hoagland nutrient solution for 15 days when new roots and tillers developed. After 15 days a set of plants were fed with N^{15} enriched ammonium sulphate and in the other set the plants were allowed to grow without any nitrogen for another 10 days to make them nitrogen starved. All the plants treated with and without nitrogen were then fed with $^{14}CO_2$ gas in specially made perspex sheet chamber for 30 minutes under natural sunlight. The plants immediately after feeding with $^{14}CO_2$ gas were kept at $0^{o}C$ in a refrigerator. The radioactivity in the plant samples, separated into shoots and roots was measured with a gas flow counter. From the plant parts, N was determined by the micro-Kjeldahl method after digesting the samples in a tri-acid mixture (Jackson, 1958).

Table I. Effect of age of seedling on nitrogen content (%) of rice plant sampled on the day of $C^{14}O_2$ feeding.

Age of seedling on day of $C^{14}O_2$ feeding.	Shoot		Root	
	+N	–N	+N	–N
74	2.87	2.58	2.90	1.26
59	3.24	2.07	1.70	1.53
44	3.55	2.03	2.02	1.76
29	3.76	2.54		2.80

Results and Discussion

Nitrogen concentration in plant shoots progressively increased with the younger seedlings fed with N^{15} and $^{14}CO_2$, but plants grown without nitrogen showed inconsistent results (Table I). This indicates that the plants did not actually starve of nitrogen because N concentration of shoot was very much near to the optimum level. However the N content considered to be optimum for the normal growth of plants as reported by Champan (1967) and Jones (1966) are 2.4 to 3.7% and 2.7 to 3.5% respectively. The reverse appeared to be true in the case of roots in respect of age of seedlings and N content where N concentration progessively increased in roots with $^{14}CO_2$ (Table I).

The assimilation of $^{14}CO_2$ was limited in N-starved plants compared to N-fertilized plants and was maximum with the youngest plants. The translocation of $^{14}CO_2$ both in the shoots and roots was higher in N-fertilized plants except in an isolated case compared to N-starved plants (Table 2). Tanaka & Navasero (1967) observed higher accumulation of $^{14}CO_2$ in the shoots and roots of N-fertilized rice plants. Similarly plants grown at 50 ppm N had the highest rate of $^{14}CO_2$ assimilation while at lower or no

Table 2. Effect of age of seedling with and without nitrogen on assimilation of $C^{14}O_2$ by rice plant (Cpm/mg dry matter).

Age of seedling on day of $C^{14}O_2$ feeding.	Shoot		Root	
	+N	–N	+N	–N
74	1612	1500	612	166
59	3901	2137	596	185
44	1448	2731	106	223
29	11364	5300	4943	1530

nitrogen rate the $^{14}CO_2$ assimilation decreased, (Hara & Sonoda, 1981). Thus the plants growing without N was affected by $^{14}CO_2$ application.

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