J. Nuclear Agric. Biol., **32** (2) : 115-118 (2003)

SHORT COMMUNICATION

Evaluation of Two Bush Black Pepper Varieties (*Piper nigrum* L.) for Photosynthate Translocation under Water Stress

*C.K. THANKAMANI AND P.K. ASHOKAN

College of Horticulture, Vellanikkara
Trichur - 680 656, Kerala, India

(Received January 25, 2003)

The humid tropical climate of Kerala is congenial for growth and yield of black pepper. There are two morphologically different types of the crop, viz. Bush pepper and vine pepper. Regeneration by planting laterals (plagiotrophic branches) results in bush pepper, while vine pepper results from planting of runner / terminal vines (orthotrophic branches). Since, bush pepper can be grown in pots, bush pepper is suitable for the terrace gardens in urban as well as rural areas. It can easily find a place in the kitchen gardens and homesteads. Water stress influences the normal plant water relations and productivity due to its detrimental effects on photosynthesis and translocation[1]. In tomato grown under low soil moisture stress partitioning of dry matter to the stem was maximum, while roots and leaf got lesser photosynthates[2]. Difference in partitioning of photosynthates in tolerant and susceptible varieties of crops were reported[3,4,5]. Therefore an attempt was made to study the translocation of photosynthates in drought sensitive (Panniyur-1) and drought tolerant (Panniyur-5) varieties of bush pepper using ^{14}C.

The experiment was conducted in summer season of 1998 at Radio Research laboratory of College of Horticulture, Trichur, Kerala. Panniyur-1, is the first international, high yielding hybrid variety released from Pepper Research Station, Panniyur in Kerala. Panniyur-5 is another pepper variety released from same station. This variety was reported to have drought tolerance character[6]. One year old bush pepper plants of Panniyur-1 and Panniyur-5 were grown in polythene bags of dimension 40 x 20 cm filled with potting mixture containing soil, sand and farmyard manure in 1:1:1 proportion. These plants were exposed to water stress cycle for 1 day

*Indian Institute of Spices Research, Marikunnu P.O., Calicut - 673012.

(mild), 2 days (moderate) or 3 days (severe) respectively for one month. Daily irrigated plants were used as control. After two months growth under stress cycles as above, one fully matured leaf of each variety was allowed to fix ^{14}C in a custom made chamber[7] which had closed air circulation system. ^{14}C labeled sodium carbonate (Na_2CO_3) kept inside the chamber in a petridish was allowed to react with dilute hydrochloric acid to release $^{14}CO_2$, which in turn was fixed by the leaf in chamber. After inserting the leaf into the leaf chamber through the rubber beadings between the lower and upper portions, the chamber was firmly clipped to make air tight. Before commencing the experiment, the tubes were closed by a clip. After loading the leaf and setting the chamber air tight, hydrochloric acid, was run down to the petridish containing Na_2CO_3 through a burette. The leaf chamber was provided with a built in fan to facilitate circulation of the liberated gas inside the chamber. The leaves were allowed to fix $^{14}CO_2$ for ten minutes. After feeding the leaves, the unused mixture of gases were purged through the exhaust tubes into 10% potassium hydroxide absorbent solution. The chamber was opened and the plants were taken out and kept inside a greenhouse. The water stress treatments as described earlier were continued. On 14th day, these plants were cut at the basal portion and separated into stem, leaves, and berries and dried in an oven at 70 ± 5°C. The samples (0.1 g) were oxidized in a biological oxidizer using methanol, ethanol amine and cocktail solution (10:10:50). $^{14}CO_2$ counts were taken in a liquid scintillation system.

In panniyur-5 photosynthates from the leaves were translocated to the spikes on the corresponding node and small quantities to other spikes (Table 1). When the plants were exposed to moderate and severe stress, most of the ^{14}C was observed in the corresponding nodal spike only and not in other spikes. In the daily irrigated plants of panniyur-5, ^{14}C count in other spikes were negligible and most of the ^{14}C fixed in leaves were shared by the corresponding nodal spike and the stem. Under mild water stress, the ^{14}C fixed by the leaf was traced both in the nodal spike and the spikes on other nodes. There were no translocation to stem, leaves or roots. ^{14}C translocation from the leaf was traced in the corresponding nodal spike and there was no translocation to other spikes, stem or root in water stressed as well as daily irrigated plants of panniyur-1 (except in moderate stress, where a weak translocation to stem was observed). Severe water stress decreased the translocation of ^{14}C, to spikes on both the varieties. There were no translocation of ^{14}C to other leaves and roots in both the varieties in water stressed as well as daily irrigated plants.

Table 1. Translocation of photosynthates in bush pepper varieties under water stress

Plant tissue	Panniyur-5 ^{14}C counts (cpm) Water stress levels				Panniyur-1 ^{14}C counts (cpm) Water stress levels			
	0	1	2	3	0	1	2	3
Spike on the corresponding node	1930 *(46)	1058 (47)	1274 (97)	391 (100)	277 (6 (100)	247 (100)	2911 (93)	138 2 (100)
Other spikes	30.1 (.7)	1197 (53)	0	0	0	0	0	0
Stem	2253 (53)	0	40 (3)	0	0	0	291 (7)	0
Leaf	0	0	0	0	0	0	0	0
Root	0	0	0	0	0	0	0	0

*Percentage of total count in each plant

These results indicated that variety Panniyur-1 and Panniyur-5 differed in their pattern of translocation of photosynthates under water stress. Variety panniyur-5 showed water stress tolerance based on morphological, physio-biochemical and anatomical characters[6]. The efficient translocation of carbon even under water stress may be one of the basis for stress tolerance of panniyur-5. In both the varieties translocation of ^{14}C to vegetative part was less compared to reproductive parts. The source sink relationship in many species showed that reproductive structures are a stronger sink than vegetative parts. In sunflower, a mild water deficit during reproductive development resulted in an increased partitioning of assimilates to reproductive organs and reduced partitioning to the stem[3]. The results of the study indicated that in translocation of photosynthates in drought tolerant (Panniyur-5) variety is more efficient than susceptible variety (Panniyur-1) under water stress.

REFERENCES

1. **Kasturibai, K.V., Rajagopal, V., Prabha, C.D., Ratnambal, M.J. & George, M.V.**, *J. Plant Crops*, **24** (1996) 28.

2. **Gates, C.T.,** *Aust. J. Biol. Sci.,* **10** (1957) 125.

3. **Sobrado, M.A. & Turner, N.C.,** *Oecologia.,* **58** (1983) 313.

4. **Deng X.M., Joly, R.J. & Hahn, D.T.,** *Physiol. Plant.,* **78** (1990) 627.

5. **Kasturibai, K.V.,** Evaluation of coconut germplasm for drought tolerance. Ph.D thesis. Mangalore University, Mangalore, India (1993).

6. **Thankamani, C.K.,** Influence of soil moisture regimes on growth and yield in bush pepper. Ph.D. Thesis, Kerala Agricultural University, Trichur, India (2000).

7. **IAEA.,** Root activity pattern of some tree crops. Tech. Rep. 170. International Atomic Energy Agency, Vienna (1975) 154.