Short Communication

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Evaluation of Greater Yam (*Dioscorea alata* L.) Germplasm on Physiological Parameter

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Greater yam (*Dioscorea alata* L.) is a climbing monocotyledonous tuber crop belongs to the family of Dioscoreaceae and it is reported to be an old crop species native to South East Asia (Burkill 1951). Several environmental factors affect the growth of yam, in particular, the development of the flowers, tubers and bulbils. Tuber growth in yam is slow immediately after initiation and then it becomes very rapid at full canopy formation and finally slows down during maturation with a loss in dry matter (Onwueme 1978). Yam yield is influenced by numerous environmental factors such as water (soil moisture), temperature, light and photoperiod. Other constraints to yam production include biotic factors such as pests and diseases in the field and in the store. These factors have led to decrease in production over the years and have prompted breeding activities to generate high yielding varieties with some tolerance to environmental stresses. Evaluation of local cultivars or land races into different morphological variability groups makes it easy for the plant breeder in identifying and selecting the desired promising lines of different character. Evaluation of cultivars collection can be useful for germplasm curators and may also help in clarifying the evolutionary history of a crop in a region (Zeven and Schachl 1989).

The experiment was conducted in the Horticultural Research Farm (HRF), Andro, Imphal-East during 2014-2015. It is situated at a distance 32 Km from Central Agricultural University Head Quarter, Imphal. It is located at latitude of 24° 45.89′ with longitude measuring 94° 03.46′ and an elevation of 808-940 m above mean sea level. The experiment was design in randomized block design with 3 replication and 7 treatments: T_1- IGDa-4, T_2- IGDa-2, T_3-NAUDa-2, T_4- Da-199, T_5-Da-11, T_6- Da-25, T_7-Local. The details of observations are given below:

Leaf area index: Leaf area index is the ratio between total leaf area to canopy of the plant. Leaf area index per plant was calculated at 90, 135 and 180 DAP by using the formula given by Watson (1947) and expressed as follows:

$$\text{Leaf Area Index} = \frac{\text{Total leaf area (cm}^2\text{)}}{\text{Canopy of the plant (cm}^2\text{)}}$$

Harvest index (%): Harvest index is calculated by using following formula given by Yoshida (1981):

$$\text{Harvest index} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

Net Assimilation Rate (NAR) ($gm^{-2}day^{-1}$): It indirectly indicates the rate of net photosynthesis. It is expressed as (g) of dry matter produced per square meter of leaf in a day. For calculating NAR, leaf area of individual plant has to be used. It was computed by the formula given by Gregory (1926).

$$NAR = (W_2 - W_1 / L_2 - L_1) \times (\text{Log } L_2 - \text{Log } L_1 / t_2 - t_1)$$

Where,
W_1 and W_2 refer to whole plant dry weight at t_1 and t_2. L_1 and L_2 refer to leaf area on two successive periods at t_1 & t_2.

Crop Growth Rate ($gday^{-1}$): CGR indicates at what rate the crop is growing i.e. whether the crop is growing at faster rate or slower rate than normal. It was expressed as gram of dry matter produced per day, given by Gardner *et al*. (2010).

$$CGR = W_2 - W_1 / t_2 - t_1 \ (gday^{-1})$$

Where,
W_1 and W_2 refer to the whole plant dry weight on two successive periods at t_1 and t_2 respectively.

Relative Growth Rate (RGR) recorded by the formula given by Blackman (1919).

$$RGR = \log w_2 - \log w_1 / t_2 - t_1 \ (gg^{-1}day^{-1})$$

Where,
W_1 and W_2 refer to the whole plant dry weight on two successive periods at t_1 and t_2 respectively.

Relative Growth Rate (RGR) indicates rate of growth per unit dry matter. It was expressed as gram of dry matter produced by a gram of existing dry matter in a day.

There were significant differences of leaf area index among the treatments. The leaf area index increased with the advancing of days and decreased at later stage of growth, which was due to the production of more number of active leaves at early stages and later decreased due to senescence, mutual shading of leaves within the canopy caused decreased in growth. The highest leaf area index was recorded with treatment T_7 (2.83) at 135 DAP which was significantly higher than other treatments (Table 1). The minimum leaf area index was recorded from the treatment T_6 at all the stages of growth. This finding was also supported by Eruola *et al.* (2012) in white yam. The data on harvest index (%) revealed that there was significant effect of germplasms tested. The minimum harvest index was recorded from treatment T_5. The maximum harvest index (76.37%) was recorded from T_7 which was significantly higher than the other treatments except T_3 (76.03 %) and T_1 (74.40%) (Table 1). The high harvest index obtained in the mentioned treatments is due to high tuber yield. This result was in conformity with Bhagsari and Ashley (1990).

In the experiment, there were significant differences among the treatments. At 90-135 DAP, the highest net assimilation rate was observed in T_6 (0.0076g m^{-2} day^{-1}) and the minimum NAR was observed in T_1 (0.0041g m^{-2} day^{-1}) (Table 1). The higher rate of NAR at 90-135 DAP may be due to rapid increase of dry matter in the vine and tubers of the germplasms as reported by Tsuno and Fujise (1965). There were significant differences among the different treatments in respect to crop growth rate and relative growth rate which showed decreasing rate of plant growth during the time intervals of 90-135 DAP and 135-180 DAP as the growth of crop was ceased in later stage of plant. At 90- 135 DAP, the highest crop growth rate was observed in T_7 (3.10gday^{-1}) and the minimum crop growth rate was observed in T_5 (2.1 gday^{-1}). At 90- 135 DAP, the highest relative growth rate was observed in T_6 (0.0078 gg^{-1} day^{-1}) and the minimum relative growth rate was observed in T_7 (0.0042gg^{-1} day^{-1}) (Table 1). This finding was also supported by Das *et al*. (1997).

SUMMARY

A field experiment was conducted in the Horticultural Research Farm, Andro, Imphal- East during 2014-2015. The result revealed that physiological parameters like leaf area index (2.83), harvest index (76.37%) and crop growth rate (3.10g day^{-1}) were found highest in local. Net assimilation rate (0.0076 gm^{-2} day^{-1}) and relative growth rate (0.0078gg^{-1} day^{-1}) were found highest in treatment Da-25. From the studies it can be concluded that treatment T_7 (Local) was found superior with respect to leaf area index (2.83), harvest index (76.37%) and crop growth rate (3.10g day^{-1}).

Table 1 Study on physiological parameters of greater yam

Treatments	LAI (135 DAP)	HI (180DAP)	CGR (90-135DAP)	RGR(90-135DAP)	NAR(90-135DAP)
T_1	2.60	74.40	2.70	0.0066 (0.7118)	0.0041 (0.7100)
T_2	2.36	70.67	2.27	0.0069 (0.7120)	0.0046 (0.7104)
T_3	2.73	76.03	2.93	0.0075 (0.7124)	0.0068 (0.7119)
T_4	2.83	70.27	2.80	0.0078 (0.7126)	0.0060 (0.7114)
T_5	2.40	68.03	2.10	0.0052 (0.7108)	0.0060 (0.7113)
T_6	2.10	70.73	2.87	0.0078 (0.7126)	0.0076 (0.7124)
T_7	2.83	76.37	3.10	0.0042 (0.7101)	0.0052 (0.7108)
S.Ed(±)	0.06	1.80	0.066	0.00011	0.00010
CD (0.05)	0.14	3.92	0.144	0.00023	0.00022

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