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Physiology of water use efficient genotypes of groundnut (*Arachis hypogaea* L.) in *kharif* season

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SUMMARY

A field trial was carried out at Mahatma Phule Krishi Vidyapeeth, Rahuri during *kharif* season of the year 2002. The observations on different plant parameters such as photosynthetic rate, transpiration rate, water use efficiency and post harvest observations were recorded. The results observed that the genotypes T-18, J-30 and I-13 had higher yields coupled with high photosynthetic rate, however, genotypes I-23 and I-09 had lower photosynthetic rate resulted in lower yield. As regards to transpiration rate, the genotypes T-18, I-10 and J-17 had the highest transpiration rate while the high yielding genotypes J-30, I-43 and I-13 had lowest transpiration rate. From the study, it was revealed that the higher water use efficiency (WUE) was exhibited by genotypes T-18 and J-30 had higher economic yield as compared to other genotypes having less WUE.

Key words : WUE, Photosynthetic rate, Transpiration and *kharif* groundnut.

In India groundnut is the king of oilseed crops. India ranks first in area of groundnut cultivation and eighth in productivity in the world. The problem of variation in growth, development and yield of this crop plant is very complex as it involves the interaction of external factors with the physiological process of a plant *viz.*, photosynthesis, transpiration, water use efficiency etc.

Water use efficiency (WUE) is important physiological parameter for water relation studies in field crops. WUE is defined as the ratio of total dry matter produced to the total amount of water-transpired in the plant. Rainfed groundnut cultivation faces intermittent dry spells and thus, there is a need to have drought tolerant genotypes. WUE is one of the traits, which can contribute to higher productivity when water availability is limited. The development of high yield drought tolerant genotype is, therefore, a priority research issue in the state, so the study of WUE in groundnut genotype is very important. Considering all these aspects, the present investigation was planned and conducted.

MATERIALS AND METHODS

A field experiment was conducted during *kharif*, 2002 at the MAP (Medicinal and Aromatic Plant) Project Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was conducted in a Randomized Block Design with ten genotypes [*viz.* J-17 (T_1), I-09 (T_2), T-18 (T_3), I-13 (T_4), J-30 (T_5), I-43 (T_6), ICGS-76 (T_7), I-10 (T_8), T-41 (T_9) and I-23 (T_{10})] of groundnut and replicated three times in rainfed condition. The gross plot size was 3.0 x 2.10 m^2 and net plot size was 2.80 x 1.50 m^2. The sowing was done by dibbling on 22nd July, 2002 with 30 cm x 10 cm spacing. For measuring the rate of photosynthesis and transpiration in the field conditions a portable IRGA (Infra Red Gas Analyzer) has been developed in the recent years, which was used for measuring the rate of photosynthesis *i.e.* CO_2 fixation (μ mol CO_2 m^{-2} s^{-1}) and transpiration *i.e.* H_2O lost (mol H_2O m^{-2} s^{-1}) of crop plants. These measurements were recorded at flowering stage of groundnut crop. The water use efficiency (WUE) was calculated using SPAD chlorophyll meter (SPAD-502 Minolta *i.e.* Silicon Photo Amplified Diode) by calculating specific leaf area (SLA) after 35 to 55 days after sowing (DAS). Passioura (1977) considered pod yield (Yp) under limited conditions is given as.

Pod yield = T x WUE x HI

where,

T = the amount of water transpired by the crop (mm)

WUE = the efficiency of water use in dry matter production

HI = the proportion of total biomass partitioning into pods

Other formulae required for calculating WUE are given below.

(i) Adjusted SPAD=Average SPADx(Radiation/VPD)

where,

VPD = Vapour pressure deficit

(ii) Calculated SLA = (0.475 x Adjusted SPAD)+333.2

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