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EFFECT OF ORGANIC MANURES ON GROWTH PARAMETERS AND CHLOROPHYLL CONTENT IN JALNEEM (*Bacopa monnieri* L.) GROWN UNDER MID HILL CONDITIONS OF HIMACHAL PRADESH

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ABSTRACT : An experiment was conducted in Complete Randomized Block Design with three replications along with nine treatments *i.e.* T_1 - Absolute control (Soil: Sand::1:1), T_2 - T_1 + (N 100 kg/ha + P_2O_5 60 kg/ha + K_2O 60 kg/ha), T_3-T_1 + FYM (2.0 : 1), T_4-T_1+ VC (2.0 :1), T_5-T_1 + BG (2.9 :0.1) , T_6-T_1+FYM+VC(2.0 :0.5 :0.5), T_7 - T_1 + FYM + BG (2.0 :0.9 :0.1), T_8-T_1 + VC + BG (2.0 :0.9 :0.1), T_9-T_1 + FYM + VC + BG (2.0 :0.45 :0.45 :0.1). The pots were prepared by filling the mixture of soil and sand in equal proportion while Vermicompost, FYM and biozyme granules were added depending upon proportion in various treatment. All growth parameters *i.e.,* plant height, number of branches, number of nodes, number of leaves and leaf area as well as biochemical constituent (Chlorophyll content) were recorded at various growth stages of *Bacopa*. The significant variations were recorded in growth parameters. Leaf area increased in all the treatments with time till flowering stage and declined further at the time of harvest. Chlorophyll contents also increased up to flowering stage and after that showed a decrease at harvest stage.

Keywords : *Bacopa monnieri, organic manures, vermicompost, biozyme granules.*

North West Himalayas are a treasure house of medicinal plants. The ancient scriptures and the mythology are replete with references about the healing plants from the Himalayas. Himachal Pradesh a North-West Himalayan state having a geographical area of 55,673 Km^2 (about 1.7% of country's geographical area), aptly showcases this medicinal plant richness diversity of the zone that is spread over its different agro-climatic zones and vegetation types (Dhyani and Kala, 5). The state harbour about 3500 species of flowering plants, out of which about 800 species are estimated to be used for some or the other medicinal purposes within and outside the state (Cook *et.al,* 4). An analysis of the habits of the documented medicinal plants of the state shows that an over whelming majority of these are herbs (70%), followed by shrubs (15%), trees (10%) and climbers (5%). *Bacopa monnieri*, a widely distributed herb in warmer parts of Asia, Australia and America, commonly known as *brahmi, jalbrahmi* or *jalneem* in India (Barret and Strother, 1; Chopra *et.al.,*3; Kapoor,7). It is an important ancient medicinal plant. The name Brahmi is derived from the word "Brahma", the mythical "creator" in the Hindu Pantheon. Because brain is centre for creative activities, any compound that improves the brain health is called *Brahmi*. Other Sanskrit names for this plant are '*Bahuphene*', '*Ahiphena*' and '*Phenavati'*. The word 'phena' means "foaming property". When mixed with water, *Bacopa* plant part produces a stable froth that is attributed to the saponins present in the plant. Bacopa plant is a surface feeder; therefore fertility, moisture and drainage of upper layer of soil have great impact on growth, development, yield, quality and production of runners.

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MATERIALS AND METHODS

The pot experiment was conducted in the Department of Biology and Environmental sciences, COBS, CSK HP KV, Palampur and is situated at 32º6' N latitude and 72º3' E longitudes and at an altitude of 1290 m above mean sea level. This area falls in humid and wet temperate zone in the mid hills of Shivalik ranges of Himalayas. The experimental material mainly consisted of *Bacopa monnieri* explants, were collected from the Research Institute in ISM, Joginder Nagar, Himachal Pradesh. Organic manures (FYM and Vermicompost), Biozyme granules, Chemical fertilizers (N, P_2O_5 and K_2O) and experimental pots were

procured from Department of Biology and Environmental Sciences. The soil of experimental area was clay loam in texture. Various physiological studies were undertaken both in pots as well as in the laboratory. The trial was carried out by transplanting the plantlets in the month of March with various levels of organic manures. The irrigation was applied after transplanting and then on alternate days/when required. The experiment was conducted in Complete Randomized Block Design with three replications along with nine treatments i.e. T_1 - Absolute control (Soil: Sand : : 1 : 1) , T_2 - T_1 +(N 100 kg/ha + P_2O_5 60 kg/ha + K_2O 60 kg/ha), T_3 - T_1 + FYM (2.0 : 1), T_4 - T_1 + VC (2.0 : 1), T_5-T_1 + BG (2.9:0.1) , T_6 - T_1 + FYM + VC (2.0 : 0.5 :0.5), T_7 - T_1+ FYM + BG (2.0 :0.9 :0.1), T_8 -T_1 + VC + BG (2.0 :0.9 :0.1), T_9 - T_1 + FYM + VC + BG (2.0 : 0.45 : 0.45 :0.1). The pots were prepared by filling the mixture of soil and sand in equal proportion. Vermicompost, FYM and biozyme granules were added depending upon proportion in various treatments. Four explants of *Bacopa monnieri* were transplanted in each 36 pots of 20 cm diameter, out of these 36 pots, 18 were used to record morphological observations at 14 days interval till harvest. Remaining 18 pots were used for plant sampling at each of the stages of plant growth. These were vegetative growth stage, flowering and maturity. The plants were watered on alternate days and manual weeding was done regularly. The plant height was recorded at fortnight interval. It was measured in cm from the soil level up to the tip of youngest leaf with the help of meter rod and their mean values were used for statistical analysis. Counting of shoot branches per plant was done manually in field after each 14 days from date of transplanting. Number of nodes was counted in the field after fortnight interval from transplanting date and their mean values were used for statistical analysis. The number of leaves was counted manually in the field during three stages of plant growth *i.e.,* on vegetative, flowering and maturity and their mean values were used for statistical analysis. Leaf area per plant was recorded at vegetative, flowering and maturity stages with leaf area meter (Laser leaf area meter CI-203, CID. Chlorophyll content was calculated by Dimethylsulphoxide (DMSO) method given by (Hiscox and Israelstam, (6) 100 mg of fresh leaves portion from each treatment was finely chopped and was dipped in a test tube containing 5 ml of DMSO. The test tube was then placed in an oven at 60º C for about two hours or more (if required) to facilitate the extraction of pigments. After requisite period and on attaining room temperature absorbance was read at 645 nm and 665 nm in a spectrophotometer and the chlorophyll content was determined using the following equation at three stages of plant growth. Total chlorophyll was calculated by formula- 20.2 × A645 + 8.02 × A665 (µg/g).

RESULTS AND DISCUSSION

The plant height increased with time in all the treatments but the difference in height was more prominent after 98 days of plant growth (Fig. 1). In the treatment T_8 plant height was recorded maximum

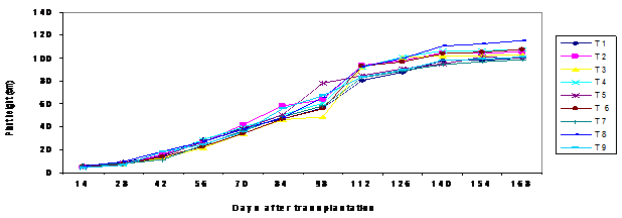

Fig. 1: Effect of organic manures and biozyme granules on height in *B. monnieri.*

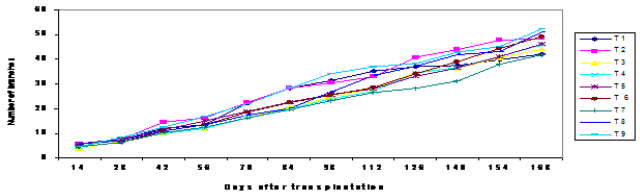

Fig. 2: Effect of organic manures and biozyme granules on number of branches.

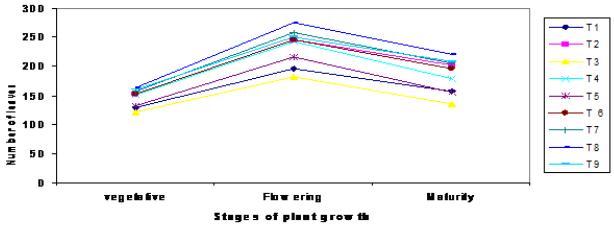

Fig. 3: Effect of organic manures and biozyme granules on number of nodes.

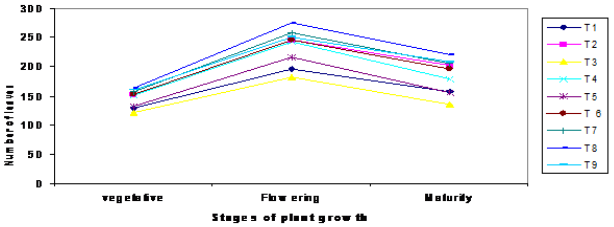

Fig. 4: Effect of organic manures and biozyme granules on number of leaves.

followed by T_4 and T_6 and were statistically at par with

each other. Minimum height was recorded in T_7 followed by T_5 and was at par with T_1. Number of branches, just like plant height, increased gradually in all the treatments (Fig. 2). The increase, however, was most marked and significant in T_2 till 126 days. Maximum number of branches after 168 days was recorded in T_9 followed by T_8 and T_6 and was statistically at par with each other. Minimum number of branches was recorded in T_7 followed by T_1 and T_3 after 168 days. Like plant height and number of branches, number of nodes also increased gradually in all the treatments. These results are in close agreement with (Bone, 2). The increase however was most marked and significant in T_2 till 112 days. Maximum number of nodes was recorded in T8 after 168 days followed by T_9, T_7 and T_6 and were at par with each other. Minimum number of nodes was recorded in T_1 after 168 days followed by T_3 and T_5. Number of leaves increased in all the treatments with time. The difference in the number of leaves was more significant during/after vegetative stage in all the treatments. Maximum number of leaves after flowering was recorded in T_8 followed by T_7 and T_9 and was statistically at par with each other. Minimum numbers of leaves were recorded in T_3 followed by T_1 and T_5. Leaf count was slightly decreased at maturity due to shedding of leaves (Fig. 4). As per data depicted in table leaf area increased in all the treatments with time till flowering stage and declined further at the time of harvest. At flowering stage, maximum leaf area was recorded in T_9 followed by T_8 and T_6. Minimum leaf area was recorded in T_1 followed by T_3 and T_5 being statistically at par with each other. Chlorophyll contents increased up to flowering stage and after that showed a decrease at harvest stage. Maximum chlorophyll was found in T_8 at flowering stage followed by T_9, T_6 and T_4 and was statistically at par with each other. At vegetative and maturity stages maximum chlorophyll was recorded in T_9. Minimum chlorophyll was found in T_3 and T_1 at vegetative, flowering and maturity stages, being statically at par with each other and chlorophyll content were. Application of vermicompost along with biozyme granules significantly attributed towards the overall growth of plants along with number of leaves, nodes, leaf area and total chlorophyll by providing organic nutrition which would have enhanced the assimilation rate as compared to inorganic nutrition provided. Similar results have been documented by Shirole *et al.* (8) and Tandon (9).

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