IJALS (2015), Volume 1 (1) pp.6-10

sky fox
OPEN ACCESS

International Journal of Agricultural and Life sciences

ISSN: 2454-6127.
www.skyfox.co/journal

Research Article

Influence of Organic Bio Fertilizers on Bio Physical and Physiological Parameters in *Daucua Carota L.*

Babli Mog [1*]

* 1. Ph.D scholar, Dept. of Crop Physiology, University of Agricultural Sciences, Bangalore, India*, 560 065.
*Author to whom correspondence should be addressed; E-Mail: bablicph@gmail.com

Received: Dec 2014 / Accepted: Jan 2015/ Published: Feb2015

Abstract: A field experiment was conducted at the Main Agricultural Research Station, University of Agricultural Sciences, a Dharwad during rabi season of 2006-2007 to study the effect of organics and bio fertilizers in carrot. The experiment was laid out in Randomized block design with eleven treatments and three replications. The morphological parameters viz., plant height was significantly higher due to application of RDF +Azospirillum (500g/ha) compared to other treatments. Total dry weight differed significantly among treatments at all the stages. Among treatments, significantly higher total dry weight was recorded with the application of RDF +Azospirillum (500g/ha). All growth parameters viz., Leaf area index (LAI), Absolute growth rate (AGR), Crop growth rate (CGR), Net assimilation rate (NAR) and Biomass duration (BD) were significantly higher with the application of RDF +Azospirillum (500g/ha) compared to other treatments.

Keywords: Biofertilizers, Azospirillum, carrot, Leaf are index, Net assimilation rate, Biomass duration

INTRODUCTION

Carrot *(Daucus carota* L.) is an important vegetable crop grown all over the world during summer and winter in temperate regions and during winter in tropical and subtropical regions. The major carrot growing states in India are Punjab, Uttar Pradesh, Karnataka, Tamil Nadu and Andhra Pradesh (Kumar *el al.,* 2004). The total cultivable area under carrot in India is 22.53 ha with an annual production of 4.14 lakh tons and the share of Karnataka is 2968 hectares with an estimated production of 44,520 tons (Kumar *et al.,* 2004). Carrot is a root crop and is used as a vegetable for soups, stows, curries and pies; grated roots are used as salad. Tender roots are used for making pickles and halwa. Carrot juice is very popular and is the main source of carotene and is also used as colouring buffer in food preparation. Carrot leaves (tops) are also used in many countries as a source for extraction of leaf proteins, fodder and for the preparation of poultry feed. Carrot root is an excel1ent source of carotene (1890 mg/100 g fresh weight) and precursor of vitamin A and fiber. Deficiency of vit.A causes xenophthalmia, an eye ailment. In India, there is an alarming situation of vit.A deficiency, particularly in children. Several medicinal qualities are also attributed to this vegetable crop such as cooling effect on the body, strengthening effect on the heart and brain, prevention of constipation and possession of diuretic properties. Although, this root crop has lot of potentialities and widely cultivated since long, yet its yield per acre remains very low and there is lot of need to increase the production potential of carrot without environmental degradation.

Several attempts have been made to increase yield potential of root crops, but they are concerned with use of inorganic fertilizers which results in loss of soil fertility and soil health. In this context, the use of organics and biofertilizers like FYM, vermicompost, poultry manure and *Azospirillum* is gaining more importance for getting higher yield and quality. Farm yard manure being bulky organic material, releases the soil compactness and improves the aeration in addition to the supply of essential plant nutrients and organic matter and increase soil microbial establishment along with accumulation of excess humus content. Vermicompost is rich in both in macro and micro nutrients. The *Azospirillum* apart from its role in nitrogen fixation from the atmosphere is also involved in production of bioactive substances. Organically produced fruits, vegetables, food crops fetch much higher value not only in the international market but also in the domestic market. They are known to be devoid of any residues, thereby

having positive impact on human health. The literature pertaining to the use of organics and biofertilizers in vegetable crops particularly in carrot is very much limited. This study would reveal the impact of these manures not only on the morpho-physiological parameters but also on bio physical parameters too.

2. Materials and methods

A to study the effect of organics and biofertilizers on morpho-physiological and bio physical parameters. Dharwad local variety was selected for the study. The experimental site consisted of medium black clay loam soil with the following treatments involving organics and biofertilizers applied before sowing. A common dose of RDF (75: 62.5: 50 kg NPK) was supplied to all the treatments receiving organics and biofertilizers.

2.1. Treatment details:

T_1 - Control (RDF)
T_2 - RDF + Vermicompost (2.0 t/ha)
T_3- RDF + Vermicompost (3.0 t/ha)
T_4- RDF + FYM (5 t/ha)
T_5- RDF + FYM (10 t/ha)
T_6 - RDF + *Azospirillum* (500 g/ha)
T_7 - RDF + Poultry manure (2.5 t/ha)
T_8 - RDF + Poultry manure (5 t/ha).
T_9 - RDF + Phosphorous solubilizing bacteria (PSB) 500 g/ha
T10 - RDF + Neem cake (200 kg/ha)
T11- RDF + Press mud (2 t/ha)

The experiment was laid out in randomized block design (RBD) with II treatments with one local variety and three replications. Sowing was done In November after first rain, received during both seasons and seeds are hand dibbled at a depth of about 2 cm in the soil. Thinning was done at 20 days after sowing by retaining one seedling per hill. Five plants were selected randomly from each plot and were tagged at 15 DAS for recording various morphological and physiological parameters at different stages of crop growth.

2.2. Morpho-physiological parameters

2.2.1. Plant height (cm)

Plant height was recorded from base of the root to the tip of the plant at 40, 60 days and sowing and at harvest. Average plant height was then expressed in cm.

2.2.2. Leaf area index (LAI)

The LAI was calculated by dividing the leaf area per plant by the land area occupied by the plant (Sestak *et al.,* 1971).

$$LAI = \frac{\text{Leaf area (cm}^2\text{/plant)}}{\text{Land area (cm-/plant)}}$$

2.2.3. Absolute growth rate (AGR)

It is the dry matter production per unit time (g/plant/day) and was calculated by using the following formula.

$W_2 - W_1 = AGR$

where,

W_1 = Dry weight of the plant at time t_1
W_2 = Dry weight of the plant at time t_2
$t_2 - t_1$ = Time interval in days

2.2.4. Crop growth rate (CGR)

Crop growth rate is the rate of dry matter production per unit ground area per unit time (Watson, 1952). It was calculated by using the following formula and expressed in *g/m²/day.*

$$CGR = \frac{W_1 - W_2}{t2 - t1} \times \frac{1}{A}$$

where,

W1 = Dry weight of the plant *(g/m²)* at time
Tl = Dry weight of the plant *(g/m²)* at time
t2 = Time interval in days
A = Unit land area

2.2.5. Net assimilation rate (NAR)

Net assimilation rate is the rate of dry weight increase per unit leaf area per unit time. It was calculated by following formula of Radford (1967) and expressed as g/dm2/day.

$$NAR = \frac{W2 - W1}{t2 - t1} \times \frac{\log_e L_2 - \log_e L}{L2 - L1}$$

where,

L1 and W1 = Leaf area (cm') and total dry weight of the plant (g), respectively at time t1.
L1 and W2 = Leaf area (cm²) and total dry weight of the plant (g), respectively at time t2.
T2-t1= Time interval in days

2.2.6. Biomass duration (BMD)

The BMD was calculated by using the following formula and expressed in days (Sestak *el al.,* 1971).

$$BMD = \frac{TDMi + TDM(i+1)}{2} \times (t2 - t1)$$

Where,

TDMI = total dry matter at ith stage
TDM (i+ 1) Total dry matter at (i+1) stage
t2-t1 = Time interval (days) between ith stage and (i+1)th stage

3. Results and discussion:

3.1. Morphological parameters

3.1.1. Plant height (cm)

The data on plant height as influenced by organics and biofertilizer showed significant difference at all the stages (Table

1). Among all the treatments, application of RDF + Azospirillum (500 *g/ha)* recorded significantly higher plant height followed by application of RDF + poultry manure (5 *t/ha)* and RDF + neem cake (200 kg/ha) at all the stages.

Application of only RDF recorded lower plant height at all the stages. At 40 DAS, application of RDF + Azospirillum (500 *g/ha)* showed significant differences with other treatments except with treatments RDF + vermicompost (2.0 t/ha), RDF + vermicompost (3.0 t/ha), RDF + poultry manure (5 t/ha) and RDF + neem cake (200 kg/ha) which were found on par with each other. At 60 DAS, application of RDF + Azospirillum (500 *g/ha)* was on par with other treatments except treatments, RDF + PSB (4 kg/ha) and RDF + press mud. At harvest, application of RDF + Azospirillum (500 *g/ha)* showed significant differences with other treatments except with treatments RDF + vcrmicompost (3.0 t/ha), RDF + FYM (5 t/ha). RDF + poultry manure (5 t/ha) and RDF + neem cake (200 kg/ha) which were on par with each other.

The role of organic manure in enhancing the growth characters is well known and they have a positive relationship with growth. Farmyard manure (FYM) being a bulky organic material, reduces the soil compaction and improves the aeration in addition to the supply of essential plant nutrients and organic matter, thereby increasing the soil biological activities. The FYM also provide room for the better microbial establishment along with accumulation of excess humus content (Haywarth *et al., 1966).* Various morphological characters play an important role in yield determination and are of immense importance in understanding the plant growth and development. Organics and biofertilizers have been known to influence morphological characters such as plant height, dry matter production and its distribution into different plant parts. Basically plant height is genetically controlled character but is also being influenced by environmental conditions and management practices. Several studies indicated that plant height is increased by the application of organics and biofertilizers. The present study revealed significant differences among the treatments at all growth stages and the maximum plant height was recorded in RDF + *Azospirillum* (500 g/ha). The increase in plant height might be attributed to the N,-fixation by *Azospirillum* which inturn make the essential nutrients available to the plant growth and development. These substances have also been reported to increase the activity of cell division and cell elongation ultimately leading to an increased plant height. Similar results have also been reported from Fallik and Okon (1996) in *Setaria italica,* cauliflower,coffee and tea seedlings (Merina, 1995). Higher plant height was also recorded in treatment RDF + poultry manure (5t/ha). These results are in conformity with the reports of Channabasavanna *et al.* (2001) who revealed that the maximum plant height of maize was observed with the application of poultry manure. Increase of plant height due to poultry manure could be due to the presence of growth promoting substance which in turn stimulated the efficiency of nutrient uptake and thus lead to increased plant height). Among several morphological characters associated with yield, the maintenance of functional leaves is primarily important since, it is the site of assimilate production. The present investigation showed that the treatment RDF + Azospirillum (500gm/ha) followed by RDF + poultry manure 5t/ha) had the maximum yield, which might be due to the increased plant height which eventually gave scope to increase in assimilate production and thus yield. Naidu *et al.,* (1999) reported that the morphological parameters were affected significantly due to the application of different combination of organics, chemicals and biofertilizers.

3.2. Dry matter production and its distribution

The data on total dry weight presented in Table 2 indicates significant differences between the treatments. It was found to increase from 40 DAS to till harvest. All the treatments such as organics and biofertilizers recorded significantly higher total dry matter al all the stages. The treatment RDF + Azospirillum (500 g/ha) recorded significantly higher total dry weight at all the stages. Lower total dry weight was recorded in treatment RDF (control) at all the stages. At 40 DAS, treatment RDF + Azospirillum (500 g/ha) showed significant differences with all the other treatments. At 60 DAS, treatment RDF + Azospirillum (500 g/ha) was on par with treatments RDF + vermicompost (3.0 t/ha), RDF + poultry manure (5 t/ha) and RDF + neem cake (200 kg/ha. At harvest, treatment RDF + Azospirillum (500 g/ha) was also on par with treatment RDF + poultry manure (5 t/ha). The dry matter production is of greater significance in the determination of yield. With the application of organics and bio fertilizers, the canopy structure and partitioning of assimilates can be improved.The present study also revealed significant differences in total dry weight of plant between the treatment with RDF + *Azospirillum* (500g/ha) followed by RDF + poultry manures (St/ha) having maximum values. In carrot (Sendur *et al.,* 1998) indicated that the application of RDF along with vermicompost and *Azospirillum* recorded higher growth and dry matter accumulation).

3.3.Growth parameters

3.3.1. Leaf area index (LAI)

The data on leaf area index (LAI) as influenced by organics and biofertilizers showed significant differences among all the treatments (Table 3). Leaf area index (LAI) as influenced by application of organics and biofertilizers at various growth stages was found to increase from 40 DAS till the harvest. Among all treatments, RDF + Azospirillum (50 g/ha) recorded maximum LAI compared to other treatments at all the stages. The lowest leaf area index was recorded in treatment RDF (control) at all the stages the treatment RDF + Azospirillum (500 g/ha) showed significant difference with all treatments except with treatment

RDF + poultry manure (5 t/ha) at 40 DAS. At 60 DAS, RDF + Azospirillum (500 g/ha) was on par with other treatments except with treatments RDF + vermicompost (3 t/ha). RDF + poultry manure (5 t/ha) and RDF + neem cake (200 kg/ha.But at harvest, treatment RDF + Azospirillum (500 g/ha) showed significant differences with all the treatments.

3.3.2. Absolute growth rate (g/day)

The data on absolute growth rate (AGR) indicated significant difference among all the treatments at all stages (Table 4). However, among all the treatments, application of RDF + Azospirillum (500 g/ha) recorded significantly higher absolute growth rate followed by RDF + poultry manure (5 t/ha) and were differed significantly with each other at both stages. Among all the treatments, lower absolute growth rate was recorded with application of RDF + phosphorous solubilizing bacteria (PSB) and lowest absolute growth rate was recorded in treatment RDF (control) at both stages. At 40-60 DAS, treatment RDF + Azospirillum (500 g/ha) showed significant differences with all treatments and similar results were also recorded at 60 DAS harvest respectively.

3.3.3. Crop growth rate (g^2/day)

The data on crop growth rate (CGR) revealed significant differences among all the treatments at all the stages (Table 5). Maximum CGR was recorded at 60 DAS harvest. All the treatments showed significantly higher crop growth rate compared to RDF (control) at all stages. However, among all the treatments, application of RDF + Azospirillum (500 g/ha) recorded significantly higher crop growth rate (CGR) followed by RDF + poultry manure (5 t/ha) and RDF + neem cake (200 kg/hal at all the stages. Lower crop growth rate was observed in RDF (control) at all the stages. At 40-60 DAS, treatment RDF + Azospirillum (500 g/ha) showed significant differences with all treatments except with treatment RDF + poultry manure (5 t/ha) and RDF + neem cake (200 kg/ha. At 60 DAS harvest, treatment RDF + Azospirillum (500 g/ha) showed significant differences but it was on par with treatments RDF + poultry manure (5 t/ha) and RDF + neem cake (200 kg/ha.

3.3.4. Net assimilation rate (g/dm^2/day)

The data on net assimilation rate (NAR) indicates significant difference among all the treatments except at 40-60 DAS (Table 6). It is evident from table 8 that NAR was maximum at 40-60 DAS and then declined at 60 DAS harvest in all the treatments. Among all treatments application of RDF + Azospirillum (500 g/ha) recorded higher net assimilation rate compared to other treatments and lower net assimilation rate was recorded in treatment RDF (control) at all the stages. At 60DAS harvest, treatment RDF + Azospirillum (500 g/ha) showed significant differences with other treatments except with treatment RDF + poultry manure (5 t/ha). However, at 40-60 DAS, there were no significant differences between the treatments.

3.3.5. Biomass duration (g/days)

It is evident from Table (7) that biomass duration (BMD) increased from 10-60 DAS to 60 DAS at harvest, irrespective of the treatments. At 40-60 DAS, maximum biomass duration was observed with application of RDF + Azospirillum (500 g/ha) followed by RDF + poultry manure (5 /ha) and were on par with each other. At 60 DAS harvest, treatment RDF + Azospirillum (500 g/ha) also recorded maximum biomass duration and showed significant differences with all other treatments the biomass duration was significant lower in control at all the stages.

It is well established that the infrastructure of the plant is decided by the growth parameters like LAI, LAP, CGR, AGR, NAR and BMD. The growth analysis technique has been adopted as one of the standard approaches in the absence of sophisticated instruments to analyze the structure of yield in several crops. In the present investigation, it was observed that the treatments differed significantly with respect to LAI, LAD, CGR, AGR and NAR at all growth stages except at 40 - 60 DAS in case of NAR). Leaf area fairly gives a good idea of photosynthetic capacity of the plant. Significant differences were noticed with regard to leaf area index among the treatments at all growth stages. The treatment RDF+ Azosirillum (500 gm/ha) showed significantly higher leaf area index. The increase in leaf area index could be attributed to increased cell division and elongation resulting in increased leaf expansion, more number of leaves due to beneficial influence of biofertilizers which release growth promoting substances and enhances the availability of nitrogen. This is in agreement with the results of Hemavathi (1997) and Gadagi *et al.* (1999) in chrysanthemum and gillardia. Treatment RDF + poultry manure (St/ha) also maintained higher LAI throughout the crop growth which could be due to higher LA in this treatment. Similar results were also noticed by Rao and Shaktawat (2001) who stated that the application of poultry manure increased the LAI in groundnut. The growth parameters such as AGR and CGR are intended to indicate the development of crop in a logical sequence and elucidate the causes for differences in yield through the events that had occurred earlier in growth. In general, AGR and CGR' increased as growth advanced. NAR indicates the amount of dry matter produced per unit leaf area per unit time, thereby signifying the importance of assimilatory surface area in dry matter production. The NAR was found to decrease from 60 DAS to harvest in all the treatments and such a decline at later stages could be attributed to the mutual shading of leaves with an advancement of crop phenology.

References:

Kumar JC Sharma N Sharma,PB PaulY 2004 India. J. Hortic 31 262-267.

Sestak Z. Catasky J Jarvis PG 1971 Plant photosynthetic production: Manual of Methods (Ed. Junk N.V.) The Haque Publishers, pp. 72-78

Radford DJ 1967Growth analysis formulae: their use and abuse. Crop Sci., **7** 171-175

Haywarth F, Cleawer TJ Bran JM.1966 The effect of different manorial treatments on the yield and mineral composition of early patato J Hort Sci. 41(3)225-241

Merina PS 1995 Response of certain horticultural crops to inoculation with fungi Azospirillum and phosphobacteria. M.Sc. (Agri) thesis, Tamil Nadu Agril. Unvi Coimbatore

Channabasavanna AS Biradar D P Yelamali SG.2001 Effect of poultry manure and NPK on growth and yield of maize. Karnataka J. Agric. Sci 15 2 353-355

Naidu AK Kushwah SS Dwivedia YC 1999 Influences of organic manure, chemical and biofertilizers on growth, yield and economics of brinjal South Indian Hortic 50 370-376

Sendur K S Natarajan S Thamburaj S 1998 Effect of organics and inorganic fertilizers on growth, yield and quality of tomato. South Indian Hortic 46 203-205

Hemavathi M 1997 Effect of organic manures and biofertilizers on growth and productivity of chrysanthemum M.Sc. (Agri) Thesis Uni. Agric. Sci Bangalore

Gadagi R S Hanchimani, M S.Hiremath, S M 1999 Response of ornamental crops to free living nitrogen fixing biofertilizers in conjunction with nitrogen levels. XI southern Regional Conference on Microbial Inoculants Guntur, NSB- 12-7

Rao S S Shaktawat 2001 Effect of organic manure phosphorus and gypsum on growth, yield and quality of groundnut. Indian J. Plant Physiol 6 (3) 306-311

CONFLICTS OF INTEREST

"The authors declare no conflict of interest".