"SOILTESTBASEDFERTILIZERREQUIREMENS FOR ORIENTAL PICKLING MELON (*Cucumis melo* var. conomon)"

By

LAMINA V.K
(2007-11-102)

THESIS

Submitted in partial fulfillment of the requirement for the degree of

Master of Science in Agriculture

(Soil Science and Agricultural Chemistry)
Faculty of Agriculture
Kerala Agricultural University, Thrissur

Department of Soil Science and Agricultural Chemistry

COLLEGE OF HORTICULTURE

VELLANIKKARA THRISSUR- 680 656

KERALA, INDIA

2009

DECLARATION

I hereby declare that the thesis entitled, **"Soil test based fertilizer requirements for oriental pickling melon (*Cucumis melo* var. *conomon*)"** is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other university or society.

Vellanikkara,
2/11/09

Lamina V.K
(2007-11-102)

CERTIFICATE

Certified that the thesis entitled, **"Soil test based fertilizer requirements for oriental pickling melon (*Cucumis melo* var. *conomon*)"**is a record of research work done independently by Mrs. **Lamina V.K** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, associateship or fellowship to her.

Vellanikkara
2/11/09

Dr. Betty Bastin
(Major Advisor, Advisory Committee)
Professor (STCR project),
Department of Soil Science and
Agricultural Chemistry,
College of Horticulture,
Vellanikkara

CERTIFICATE

We, the undersigned members of the advisory committee of Mrs. **Lamina V.K,** a candidate for the degree of **Master of Science in Agriculture**, with major field in **Soil Science and agricultural Chemistry,** agree that the thesis entitled **"Soil test based fertilizer requirements for oriental pickling melon (*Cucumis melo* var. *conomon*)"**may be submitted by **Mrs. Lamina V.K,** in partial fulfillment of the requirement for the degree.

Dr. Betty Bastin
(Major Advisor, Advisory Committee)
Professor (STCR project),
Department of Soil Science and Agricultural Chemistry,
College of Horticulture, Vellanikkara

Dr. K.A. Mariam
(Member, Advisory committee)
Professor& Head,
Department of Soil Science and
Agricultural Chemistry
College of Horticulture, Vellanikkara

Dr. M. A. Hassan
(Member, Advisory committee)
Professor and PI (STCR Project),
Department of Soil Science &
Agricultural Chemistry,
College of Horticulture, Vellanikkara

Sri. S. Krishnan
(Member, Advisory committee)
Assistant Professor (Selection grade),
Department of Agricultural Statistics,
College of Horticulture, Vellanikkara

Acknowledgement

Words cannot express my deep sense of gratitude and indebtedness to Dr. Betty Bastin, Professor, Department of Soil Science and Agricultural Chemistry, and chairperson of my Advisory Committee. I wish to place my heartfelt thanks to her for the inspiring guidance, untiring help, patience, encouragement, constructive criticism and valuable suggestions during the period of the investigation and preparation of the thesis.

I express my sincere gratitude to Dr. K.A. Mariam, Professor & Head, Department of Soil Science and Agricultural Chemistry and member of my advisory committee for her valuable suggestions and guidance for the completion of the research programme and preparation of the thesis.

I am ever grateful to Dr. M. A. Hassan, Professor, Department of Soil Science and Agricultural Chemistry and member of my advisory committee for his invaluable help, guidance and critical assessment throughout the period of the work. I thank him for all the help and cooperation he has extended to me.

I am deeply obliged to Sri. S. Krishnan, Assistant Professor, Department of Agricultural Statistics and member of my advisory committee for his invaluable help, relevant suggestions and whole hearted cooperation throughout the period of investigation.

I am extremely delightful to place on record my profound sense of gratitude to Dr. P.R. Suresh, Department of Soil Science and Agricultural Chemistry, for his suggestions and invaluable help in my chemical analysis during the conduct of this research work.

I also avail this opportunity to pay my sincere obligations and heartfelt thanks to Dr. K.C. Marykutty (Rtd. Professor& Head), Dr.P.K. Sushama and Dr.P. Suresh Kumar of Department of Soil Science and Agricultural Chemistry for their encouragement and kind help offered at different stages of the study.

I wish to extend my wholehearted gratitude to Mr. Eldho (PhD), Mr. Joshi, (SRF), IASRI, New Delhi, for their invaluable help in my statistical analysis during the conduct of this research work. I also thank Mrs. Sreelekha (MSc. Biochemistry) for her help in my thesis preparation.

I thank Mr. Pushpahasan and Mr. Kochaniyan varriar, for their great mind to lend their fields for my experiments. I thank Mr.P.R. Sathyan (Farm Manager) and Mr. M. Ananthakrishnan(Farm Officer) of Department of Soil Science and Agricultural Chemistry , for their help in the field experiment during the conduct of this research work.

I wish to express my sincere thanks to all the non-teaching staff members and labourers of Department of Soil Science and Agricultural Chemistry, for their whole hearted cooperation and timely assistance.

I express my deep sense of gratitude to my beloved seniors, Jyothi chechi, Geetha chechi, Kimi, Swetha, Sajnanadh chettan, Ratheesh chettan and Unnikrishnan chettan who helped me in several ways for the completion of this venture.

Words fall short as I place on record my indebtedness to my class mates and friends, SreeVidya, Jisha,Kanimozhi, Saranya, Suja, Shivaji, Mittu, Dhinesh, Kiran and Vijith for their prompt help and unliving support. I also thank my juniors Sruthy, Neethu, Ambily, Shijini, Suma, Sudha, Thuvasan and Randeep for their help and support.

Special thanks go to Santhosh chettan, Students Computer Club, COH, for rendering necessary help whenever needed.

With gratitude and affection, I recall the warm blessings and motivation from my parents, husband, sister, brother and relatives without which this endeavour would never have become a reality.

Above all, I bow my head before Almighty, for enlightening and making me confident and optimistic throughout my life.

Lamina V.K.

ABBREVIATIONS

AICRP	All India Co-ordinated Research Project
$BaCl_2$	Barium chloride
Ca	Calcium
CD	Critical difference
EDTA	Ethylene Diamine Tetra Acetic acid
Fe	Iron
FP	Farmers' Practice
g	Gram
GRD	General Recommendations of KAU
ha	Hectare
HCl	Hydro chloric acid
IARI	Indian Agricultural Research Institute
K	Potassium
KAU	Kerala Agricultural University
kg	Kilogram
N	Nitrogen
m	Metre
M	Molar
Mg	Magnesium
mg	Milligram
ml	Millilitre
ORG	Organics alone
P	Phosphorus
pH	Hydrogen ion concentration
%	Percentage
STCR	Soil Test Crop Response
STCR 1	Soil Test Crop Response for an yield target of 30 t ha^{-1}
STCR 2	Soil Test Crop Response for an yield target of 45 t ha^{-1}
STL	Soil Test Laboratory Recommendations
STVs	Soil Test Values
T	Targeted yield
t	Tonne
TNAU	Tamil Nadu Agricultural University

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

Introduction

1. INTRODUCTION

Soil is the basic medium for plant growth and it contains all the essential nutrients for crop growth. Crop production can be increased through the efficient use of native and applied nutrients. An efficient fertilization means optimisation of soil nutrient replenishment with minimisation of nutrient losses to the environment (Maene, 2001). Continued use of unbalanced fertilizers results in the depletion of soil supplies of nutrients through the fertilizers and the consequent decline in fertilizer responses.

Fertilization programmes are to be based on soil properties, especially on its inherent capacity to supply nutrients to crops. Ramamoorthy (1993) reported that the real balance for maximum yield is the relative contribution from soil and fertilizers. Soil test data should be correlated with nutrient uptake by crops for making efficient fertilizer recommendations. From this data, fertilizer prescription equations are derived for a particular crop in a particular soil. The derived equations are then tested under farmer's field conditions for their reproducibility before they are generalised for large scale adoption (Sanker *et al.,* 1989). Such soil test based fertilizer recommendations avoid the wastage or under usage of fertilizers.

Reddy and Ahmed (1999) proposed that for obtaining a given yield, a definite quantity of nutrients must be taken up by the plant. This forms the basis for fertilizer recommendation for targeted yield of a crop. Soil test crop response (STCR) approach is the study of quantitative relationship between soil test values, applied nutrients and the resultant crop yield. This will enable to prescribe the nutrient requirements of crops to obtain a desired yield.

Oriental pickling melon (*Cucumis melo* var. *conomon*) belonging to the family Cucurbitaceae is an important vegetable crop of Kerala. It is used primarily as a cooked vegetable and also as a salad. It is one of the crops grown in the summer rice fallows of Kerala. The *kani vellari*, an attractive fruit, is considered as a symbol of prosperity and finds a place in *vishukkani*, the auspicious first sight during the festival of *Vishu*. The fruits which contain moderate amounts of vitamins and minerals are used in an array of traditional vegetarian dishes like *pachadi, moru curry, koottucurry, aviyal, sambar* and the like. The fruits possess cooling properties and are used as a skin moisturizer and a digestive.

Kerala Agricultural University has developed three Oriental pickling melon varieties namely Mudicode, Saubhagya and Arunima. All these three varieties are high yielding, ranging from 25 to 30 tons per hectare. The variety, Mudicode is preferred among the other varieties due to the attractive golden yellow colour of fruits. The oriental pickling melon can be grown throughout the year under Kerala conditions. However, the ideal seasons for growing this vegetable are September - December and February - May. The spacing recommended is 2 m x 1.5 m. The fertilizer recommendation for pickling melon is 70: 25: 25 N, P_2O_5 and K_2O kg ha^{-1} along with 20-25 t ha^{-1} FYM as per the "Package of Practices Recommendation-Cops'06 of Kerala Agricultural University (KAU, 2008).

These plants are trailing in nature and hence, no need for erecting pandal or similar trailing structures. However, it is better to spread dried twigs or coconut leaves in the plant interspaces. Oriental pickling melon is a quick growing crop and the fruits will be ready for harvesting from 45th day after sowing.

Combined use of organics and inorganics enhance the nutrient use efficiency. Hence soil test crop response correlation studies are conducted under integrated nutrient system (Tandon, 1994).

STCR studies focus mainly on the following aspects (IISS, 1999).

a) Target yield concept

b) Multiple regression models

c) Soil test based prescription under integrated plant nutrient supply system (IPNS)

Almost 65 percent of the soil in Kerala belongs to Laterites (KAU, 1989) and vegetables are cultivated in an area of 55 thousand hectares (FIB, 2007). Hence, this study is undertaken in laterite soils (ultisol) with the following objectives

1. Test verification of the targeted yield equations developed by the AICRP on STCR Centre, Kerala Agricultural University, for oriental pickling melon in the laterite soils.
2. To study the nutrient interactions
3. To evaluate the quality of pickling melon.

Review of literature

2. REVIEW OF LITERATURE

Soil test based fertilizer recommendation takes into consideration the fertility status and balanced fertilizer use. Chemical fertilizer application increases the crop yield under optimum level of other production factors. Literatures on various approaches for predicting the yield of crop, soil test calibration and fertilizer recommendation for oriental pickling melon based on various experiments are reviewed in this chapter.

2.1 Soil test based fertilizer recommendation

Soil testing is the key weapon in the armory of a soil scientist and an agronomist for the advisory work on judicious fertilizer use in the crop production. It leads to a correct appraisal of the fertility status of the soil and prediction of fertilizer required for obtaining a targeted or maximum return (Kanwar,1971). In order to make soil testing as productive tool for fertilizer recommendation, many successful attempts have been made by scientists. The economic and judicious use of fertilizers based on the soil tests was reported by many scientists (Ramamurthy *et al*., 1969; Kanwar, 1971; Ramammoorthy and Velayudham, 1974; Reddy *et al*., 1985 and Goswami *et al.,* 1986).

The various soil test based fertilizer recommendations put forth by soil scientists aim at utilizing both soil and fertilizer nutrients judiciously and efficiently in a manner best suited to different soil-crop- climatic condition in the block/state/country. The functional relationship between different inputs and crop yield should be quantified, to know the yield levels for various fertilizer dosage for obtaining either the maximum yield or economic yield. Efficient prediction models are quite imperative for the prediction of crop yield as well as optimisation of fertilizers (Sanker, 1986).

2.2 Important approaches

2.2.1 Nutrient Index Approach

Parker *et al.* (1951) put forth nutrient index approach which was based on soil test values (STVs) of different nutrients where the soil samples were classified into low, medium and high categories. This is useful for formulating the area wise fertilizer recommendations. This soil fertility class based fertilizer recommendations are generally followed by soil testing laboratories in India for the practical reason that such grouping reduces the complexity of making recommendations.

Cate and Nelson (1965) described the simplified method for studying the relation between STVs and percentage yield of the maximum. The critical limits of available nutrients are established by adopting graphical procedures (Cate and Nelson, 1965) and statistical procedure (Cate and Nelson, 1971) and linear response plateau (LRP) model (Anderson and Nelson, 1975). The difference between the soil types and limits of various crops were not taken into account in these calibrations (Reddy *et al.,* 1985). Thus the quantity of fertilizer recommended on the basis of soil testing is somewhat arbitrary (Biswas and Mukharjee, 1990).

This approach helps to determine soil test value beyond which fertilizer application is not required. It does not give information about how much fertilizer is to be applied in quantitative terms with different soil test values. Only probability of yield response can be predicted but not the actual yield. Therefore the yield concept is more suitable for micronutrients and not for macronutrients (Singh and Sharma, 1994).

2.2.2 Fertilizer Recommendation for certain percentage of Maximum yield

Mitscherlich (1909) developed a model for expression of the growth rate for different levels of an essential immobile nutrient in the soil. He stated that the increase in yield per unit of the added nutrient was proportional to the difference between maximum attainable and the actual yield. Bray (1948) modified the concept by introducing efficiency coefficients to soil test and applied form of nutrients and hence it was called Mitscherlich - Bray model.

In Kerala, Nambiar *et al.* (1977) proposed the ten class system to prescribe the fertilizer recommendation. They have categorised the lower fertility level to three classes, medium to four classes and higher to three classes. For each fertility class, recommendations are given based on the package of practice for each crop. But this model also has not satisfied the balanced fertilization and high level of fertilizer use efficiency.

The targeted yield approach under STCR strikes a balance between fertilizing the crop and the soil. In the targeted yield approach, it is assumed that there is a linear relationship between the grain yield and nutrient uptake of the crop. This approach forms the basis for the national programme on All India Co-ordinated Research Programme of STCR correlation studies. This approach brought up a new dimension to the value and utility of soil testing (Velayutham, 1979). Soil test calibration is intended to establish a relationship between soil nutrient levels and crop response to fertilizer. Complexity in soil test crop response studies (STCR) arises due to great diversity of soils, climate, crops and management practice (IISS, 1999)

Dhillon *et al.* (1978) and Dev *et al*. (1985) developed targeted yield equations for wheat in Ludhiana and Gurdaspur. Targeted yield equations were developed by Chand *et al.* (1986) for green gram in Punjab, Dev *et al. (*1978) for rice in tropical acid brown soils and Singh and Sharma (1978) for many crops in

Delhi. Targeted yield equations were developed for rice in Punjab, based on the farmers field trial conducted at different locations (Chand *et al.,* 1984). In Maharashtra, the State Department of Agriculture gave fertilizer recommendation for field crops based on targeted yield equation (Velayutham and Reddy, 1990).

Extensive studies have been conducted at TamilNadu Agricultural University, Coimbatore based on targeted yield approach and has derived useful equation for the desired yield target for crops like rice, maize, ragi, groundnut, black gram, soya bean, sugarcane, sunflower etc. (Rani Perumal *et al.,* 1982, 84, 87 and 88 and Loganathan *et al.,* 1995). The test verification trials in the farmer's field also established validity of the equation. Soil test based fertilizer requirements for different yield targets of castor in dry land alfisol were developed by Ahmed *et al.* (2000).

Prescription equations involving the conjoint use of organics and inorganics have been reported by Raniperumal *et al.* (1988) and Duraisami *et al. (*1989) in ragi with azospirillum, Santhi (1995) in rice with FYM and phospho bacteria, Jha *et al.* (1997) in maize with FYM, Santhi *et al.* (2002) in onion with FYM and azospirillum, Verma *et al.* (2002) in maize and wheat with FYM.

In Kerala, fertilizer prescription equations were worked out for rice variety Barathi (Swadija *et al.,* 1993), ginger (Jayalakshmi, 2001) and groundnut (Sidha, 2005) in laterite soils. Targeted yield equations have been developed for crops like Nendran banana, turmeric, rice (Aiswarya and Kanakam), sweet potato, ashgourd, bhindi, snakegourd, brinjal, chilli, pumpkin, coleus, groundnut, cucumber, bittergourd and amaranthus for the laterite soils of Kerala (IISS*,* 2007). Frontline demonstration trials have been conducted for the crops like, Nendran banana, turmeric and cassava (KAU, 2008).

Fertilizer application based on the targeted yield approach provides the assurance for the maintenance of soil fertility (Raniperumal and Velayudham,

1982). Organic manures and fertilizers can also effectively be used along with the appropriate fertilizer recommendations of targeted yield concept. Dose of chemical fertilizers are adjusted according to the level of application of organics through soil test calibrations (Raniperumal *et al.,* 1984). Combined use of organics and inorganics enhance the nutrient use efficiency. Hence soil test crop response correlation studies are conducted under integrated nutrient system (Tandon, 1994).

Ramamoorthy and Pathak (1969) reported that the targeted yield based fertilizer application would be the most economical approach. The targeted yield equations developed for a particular variety of crops for a particular soil type can be suitably extrapolated to other varieties of the sample crops and to similar soils (Velayutham, 1979). The targeted yield equations have been reported by Reddy *et al*. (1985) for groundnut in Bavasinagar, Hyderabad (red soil) Rahuri (Black soil) and Dholi (Alluvial soil). Raniperumal *et al.* (1987) reported that the fertilizer adjustment equation developed for rice var. Barathi is also suitable for varieties like IR 50, ponni and paiyur -1 in the same soil types. The prescription equations developed for the ragi var. CO11 is also suitable for var. CO12 (Duraiswami *et al.,* 1989). The targeted yield model is useful for computing fertilizer doses for varying soil test values for obtaining different yield targets. The derived doses are then tested under farmers' field conditions for their reproducibility before they are generalised for large scale adoption (Sanker *et al.,* 1989).

Reddy and Ahmed (1999) proposed that for obtaining a given yield a definite quantity of nutrients must be taken up by the plant. This forms the basis for fertilizer recommendation for targeted yield of a crop. In Hisar, Singh *et al.* (2000) developed targeted yield equation for mutated wheat, barley and cotton.

2.3 Nutrient Interactions

Organic manures like FYM and green manures in combination with inorganic phosphatic fertilizers increased phosphorus content in wheat (Gupta and Das, 1954). In melon, level of nitrogen application did not affect early yield or average weight of fruit (Peterson, 1958). Lingle and Wight (1961) conducted a fertilizer trial in melon with four levels of N (0, 60,120, & 240 kg ha^{-1}) and 3 levels of P_2O_5 (0, 25 & 125 kg ha^{-1}) and found that P fertilization was necessary for early maturity. Increased nitrogen application increased yield, but fertilizer treatment had no effect on fruit size. Shortage of nitrogen or potassium adversely affected cucumber shape (Bradley *et al.,* 1961). Higher rates of N caused a reduction in total yield in melon (Brantley and Warren, 1960). Everett (1963) recorded a significant yield increase with organic and inorganic fertilizer combinations in cucumber.

An increase in yield with increased nitrogen application, but not with phosphorus and potassium application was reported by Dhesi *et al.* (1964) in melon. Positive yield response for phosphorus and potassium in melon was reported by Sutton (1965). Increased nitrogen and phosphorus application increased yield in bitter gourd where as potassium produced a slight reduction in yield (Dhesi *et al.,* 1966). Haworth *et al.* (1966) reported that in potato, FYM with fertilizer produced much higher yield than mineral fertilizer alone. Calcium, magnesium and potassium contents in leaf tissues of squashes were dependent on the amount of nitrogen and phosphorous applied (Thomas, 1966). Increased application of nitrogen raised the nitrogen content and reduced the phosphorus and potassium contents in squashes (Thomas and Mac Lean, 1967).

Application of 25 t ha^{-1} of fresh cattle manure increased the yield of egg plant and cabbage but reduced the yield of cucumber and tomato (Omoroi *et al.,* 1972). Mathan *et al.,* (1974) reported that inorganic form of nitrogen, phosphorus and potassium produced the maximum yield where as

organic form produced the minimum yield. Nath (1976) reported that P need not be applied to cucumber under tropical conditions. Cantliffe (1977) reported that nitrogen had a direct influence on the mineral nutrient composition of pickling cucumber leaf tissues. Nilson (1979) reported that organic fertilizers increased the contents of phosphorus and calcium in the dry matter where as the amount of potassium and magnesium were uninfluenced by the fertilizer used. In a comparison study with N (0, 60 and 120 kg ha^{-1}), P_2O_5 (0, 45 and 90 kg ha^{-1}) and K_2O (0, 45 and 90 kg ha^{-1}) in oriental pickling melon, response to N was observed to be quadratic and the optimum level was 96.6 kg ha^{-1}. But P_2O_5 application did not show any significant effect. Response to K_2O was linear with respect to the fruit yield (Hassan *et al.,* 1984).

Joseph (1985) reported that the highest dose of N, P and K resulted in the highest values for N content in melon fruits. Ragimova (1987) observed that FYM @ 20 t ha^{-1} with N: P: K @ 90:90:60 kg ha^{-1} along with Mn, Cu and Co produced highest yield in cucumber. An increase in leaf nitrogen content up to 4.33 per cent of dry weight was reported in cucumber, when a nitrogen dose of 300 per cent or more than that of recommended dose was applied (Al-Sahaf and Al-khafagi, 1990). In cucumis melo, no nitrogen accumulation occurred at normal fertilizer rate (80 g N, 12 g P_2O_5, 10g K_2O and 40 g CaO /plant) during warm season. But during the cool season, nitrogen accumulation occurred even at a fertilizer rate half of the normal amount (Kim *et al.,* 1991). In cucumis melo, Buzetti *et al.,* (1993) reported that when different doses of nitrogen were applied, the leaf content increased correspondingly.

Yalcn and Topcuoglu (1994) reported that in cucumber, plant dry weight, fruit yield and concentrations of P, N, K, Ca and Mg increased with increasing rate of P application. Park and Chiang (1997) reported that in aeroponic study of *Cucumis sativus* the leaf nitrogen content increased with the concentration of nitrogen in the nutrient solution. Sirohi (1997) reported that an application of 120 - 150 kg urea, 250 kg single super phosphate and 80 kg potassium sulphate

was useful for raising a successful cucurbit vegetable. Patil *et al*. (1998) conducted experiment in cucumber var. Himangi with N fertilizer at 50, 100, 150 or 200 kg ha^{-1}, phosphorus at 50 or 100 kg ha^{-1} and potassium at 50 or 100 kg ha^{-1}. It was shown that average yields were highest (145.5 kg ha^{-1}) with 150 kg N + 50 kg P + 50 kg K ha^{-1} and average fruit diameter, number of fruits per plant were also highest in this treatment. Navarro *et al.* (1999) reported that the increase of Ca^{2+} concentration in the nutrient solution under saline conditions improved vegetative growth and fruit yield in melon. In nutrient culture experiments, cucumber var. Chinesische, Si had no direct effect on P uptake or translocation to the shoot. It was suggested that Si could act as a beneficial element under conditions of nutrient imbalance (Marschner *et al.,* 1999).

Tuncay *et al. (*1999) reported that in cucumbers, when the effects of leaf nutrient contents on quality characteristics (fruit diameter, fruit length, TSS, acidity, pH, dry matter, fruit firmness and colour) were considered, K had significant positive direct effects on all of the quality traits with the exception of dry matter, which was affected positively by P. Leaf Ca content had negative direct effects on all of the quality traits. In Cucumber, Alphonse and Saad (2000) observed an increase in vine length and yield on combined application of FYM and chicken manure. In pumpkin, Bage *et al.* (2000) reported an early yield with application of cowdung compared to other organic manures like mahua cake, mustard cake and surja. Hadid *et al.,* (2001) recorded higher fruit weight in cucumber by application of chicken manure compared to other organic manure.

In a field experiment conducted in southern Greece, Panagiotopoulos (2001) observed that nitrogen and potassium levels did not alter significantly the fruit yield in *Cucumis melo*. He also reported that nitrogen concentration of the recently matured leaves at the initial fruit stage reached high levels ranging between 4.8 and 5.3 per cent. It was decreased to 2.5-3.6 per cent at harvest time. The same trend was found for leaf P, K and Mg but the opposite trend for Ca.

An experiment was carried out in Nagaland, India, to assess the appropriate nitrogen levels for the optimum growth, yield and quality of cucumber and it was reported that nitrogen application markedly influenced the vegetative growth, bearing habit, yield and quality of fruits. In general, nitrogen applied @ 50 kg ha^{-1} gave the best results (Jaksungnaro and Akali, 2001). Potassium fertilizer application significantly enhanced the yield and enhanced the contents of ascorbic acid of cucumber (Guo *et al.,* 2004). Rodriguez and Pire (2004) conducted a study in Cantaloupe crop in Venezuela and it was reported that at harvest, the highest levels of K, Ca and Mg were found in the petioles and the lowest values in the lamina, root and ripe fruits. The highest levels of N and P were found in the lamina and ripe fruits and the lowest in the roots. They also reported the total extraction of macronutrients were 75 kg N, 7 kg P, 64 kg K, 62 kg Ca and 10 kg Mg per hectare when 28440 kg of fruits were harvested. Potassium fertilizer application reduced the content of other nutrients in cucumber, although low K rates increased the nutrient uptake of the crop (Guo *et al.,* 2004).

Experiments conducted in Bangalore, Karnataka revealed that in cucumber, the effect of varying N levels was significant on the weight, length, girth, volume and flesh thickness of fruits and plant N, P, K uptake. Application of various P levels also had positive influence on fruit length and volume and plant N, P, K uptake, whereas the different K levels had no significant effect on the fruit characters and P and K uptake by the plant (Umamaheswarappa *et al.,* 2005). In *Cucumis melo*, the yield and uptake of nitrate, phosphate, potassium and magnesium were greater with nutrient solutions containing high levels of Ca. There was no significant difference among the nutrient solutions studied for the quality parameters of fruits measured (Salas *et al.,* 2005). Gul *et al.* (2007) reported that organic manuring decreased the total yield by 22.4 per cent in comparison with inorganic nutrient solution in cucumber.

In cucumber cultivars, increasing N concentration in nutrient solution caused reduction in fruit yield and fruit dry matter. It increased the content of total nitrogen and phosphorus, but decreased potassium and calcium. This showed antagonistic effect of elements (Soltani *et al.,* 2007). Experiments were conducted in an open field using melon plants (Cucumis melo var. Prodigio) and it was found that fruit yield and fruit nitrogen content linearly increased with N levels. The antioxidant compounds in the fruits decreased after storage but it was not affected by N fertilisation levels (Ferrante *et al.,* 2008)

2.4 Quality Parameters

Quality and storage life of crops with respect to the effect of nutrition has been recognised for quite some time. The nature and amount of protein, minerals and vitamins influenced the value of consumable food. The plant nutrients applied to the soil can alter the food values of the crop. Wilcox and Morrel (1948) reported that the level of nitrogen applied had a little effect on ascorbic acid content of peas and tomato. Fischer and Parrith (1951) reported that over application of N impaired the keeping quality of apple. Rikorski and Djordjevic (1952) observed that ascorbic acid content fell rapidly during storage at room temperature in spinach and tomatoes.

Anisimov (1953) observed a reduction in ascorbic acid content under high nitrogen level in onion tops and pea leaves. Schramer and Werner (1957) reported that in different vegetables, nitrogen had a negative effect and potassium had a positive effect. Phosphorus did not affect vitamin C content. There was highly significant negative correlation between nitrogen content in leaves and storage life of apple (Eggert, 1961). Nitrogen, phosphorus and potassium application to irrigated cucumber improved dry matter and vitamin C contents (Bolotskish, 1969). Largskii (1969) found that high rate of nitrogen application increased or did not affect ascorbic acid content in cabbage and cucumbers. In melon, ascorbic acid content was enhanced by potassium followed closely by

nitrogen (Randhawa and Singh, 1970). Application of high quantity of nitrogen, phosphorus and potassium (280 kg ha^{-1}) produced fruits with highest amount of vitamin A and vitamin C (Gananakumari and Satyanarayana, 1971).

Largskii (1971) reported that nitrogen rates above 60 kg ha^{-1} inhibited ascorbic acid accumulation in cucumber, where as high phosphorus rates enhanced it. Nitrogen had a little effect on fruit size, earliness or storage quality in melon (Pew and Gardner, 1972). Increased nitrogen application significantly increased the ascorbic acid content in cauliflower (Randhawa and Bhail, 1976). In cucumber, vitamin C content increased with increasing nitrogen, phosphorus and potassium rate (Krynska *et al.,* 1976). Subbiah and Ramanathan (1982) found that added nitrogen enhanced crude protein and carotene content while it decreased the ascorbic acid content in amaranthus leaves. Added potassium had no marked effect on carotene and ascorbic acid content. Maximum average values for weight, length and breadth of fruit were recorded by the treatment which received the highest dose of nitrogen in the inorganic form and the maximum vitamin C in standard N, P and K (70:25:25 kg ha^{-1} N, P_2O_5, K_2O) in inorganic form (Joseph, 1985).

Highest rotting percentage in melon was observed with fruits under the treatment which received the highest dose of N, P and K (105, 27.5 and 27.5 kg ha^{-1}) completely in the inorganic forms (Joseph, 1985). In cucumber, female flowers/plant showed highly significant positive correlations with number of primary branches, fruit yield and fruits/plant. Longer vine length increased the number of male flowers and produced heavier fruits (Rastogi and Arya, 1990). Excessive N supply, however, reduced fruit quality. At high rates of N, cucumber yield showed no further increase, but nitrate accumulation in the fruits continued to increase (Liu and Chen, 1996).

Marti and Mills (2002) conducted an experiment in sweet potato (*Ipomoea batatas*) in USA and it was reported that the yield, dry weight partitioning, or nutrient-use efficiency could be increased by manipulating nitrogen and potassium nutrition. In cucumber (*C. sativus* cv. Tyria), application of silicon did not appear to have an effect on plant nutrition except for increased iron uptake (Dominy and Bertling, 2004). Demiral and Koseoglu (2005) conducted an experiment in *Cucumis melo* in the coastal Mediterranean region of Turkey and it was reported that it was possible to improve fruit quality by applying as much as 600 mg l^{-1} additional K to the plants without a reduction in yield.

Liu *et al.* (2006) reported that N applied at proper rates tended to increase the contents of vitamin C, soluble protein, soluble sugar and free amino acids of cucumber and thus improved their quality. Lester and Jifon (2007) reported that in Cantaloupe (Cucumis melo (reticulatus group)), fruit quality parameters such as ascorbic acid, beta-carotene, total free sugars, and soluble solids were directly related to plant potassium during fruit growth and maturation.

In musk melon fruit, ascorbic acid content was significantly higher in organic farming system than that in conventional system. Amino acid and nitrate contents in fruit pulp were significantly decreased in organic farming system, and this was related to lower nitrogen content. The fruit quality of musk melon in organic farming system was increased to a certain extent, but all these quality parameters were not affected by fertilizer amount (Song *et al.,* 2008).

Materials and Methods

3. MATERIALS AND METHODS

A study was undertaken to test verify the targeted yield equations developed for oriental pickling melon by the AICRP on STCR Centre, Vellanikkara, Kerala Agricultural University in farmers' field. For this purpose, two fields were selected, one at Pallikandam (field 1) and another at Varyathpadi (field 2) in Pattikkad area of Thrissur district during the year October 2008- January 2009. The fields are separated by a distance of 1.5 km.

The fields are located at $10^0 45^1$ latitude, $76^0 16^1$ longitude and at an elevation of 23 m from the mean sea level. The experimental areas enjoyed a typical humid tropical climate with an annual rainfall of 216.2 cm with a mean maximum and minimum temperature of 35.2 ^{o}c and 21.9 ^{o}c respectively. The relative humidity ranged from 50 to 84 percentage and evaporation rate ranged from 99.5 to 229.1 mm. The details of field experiments conducted the methods of analysis of soil, plant and fruit samples are presented in this chapter. The statistical methods followed are also included.

3.1 Initial properties of soil.

Soil samples were collected randomly at a depth of 0-30 cm from each field and analysed for the basic physico - chemical characters. The details are given in Table 1. The initial status of organic carbon, available N, P and K in soil were considered for calculating the fertilizer requirements of the crop. The soil texture was sandy loam with low water holding capacity.

Table 1. Initial properties of soil.

Sl.No.	Property	Pallikkandam	Varyathpadi
1	Texture	Sandy loam	Sandy loam
2	pH	5.40	4.70
3	EC (d S $m^{-1)}$	0.04	0.04
4	CEC [cmol(p^{+}) kg^{-1}]	3.70	4.20
5	Available Nitrogen (kg ha^{-1})	164.12	194.11
6	Available Phosphorus (kg ha^{-1})	27.57	30.52
7	Available Potassium (kg ha^{-1})	73.22	91.52
8	Organic Carbon (%)	0 .65	0.71
9	Available Iron (kg ha^{-1})	118.13	124.94
10	Available Calcium (kg ha^{-1})	71.90	72.17

3.2 Experimental details

The selected fields were divided into four equal blocks and each block into six individual treatment plots. The experimental details are furnished below.

Treatments - Six
Replications - Four
Design - RBD (Randomised Block Design)
Number of Plots / block - Six
Total number of plots - 24
Plot Size - 12 m^2
Number of pits /plot - Four
Spacing - 2 x 1.5 m^2
Number of plants /pit - Three

The planting materials (seeds) were collected from the Department of Olericulture, College of Horticulture, Vellanikkara.

Plate 1. General view of the experimental plot at Pallikandam

Plate 2. General view of the experimental plot at Varyat

The three equations developed by the STCR Centre, Vellanikkara for oriental pickling melon, grown in laterite soils were utilized for test verification in this study. The equations are shown below.

$FN = 3.24\ T - 0.095\ SN$

$FP_2O_5 = 1.64\ T - 1.332\ SP$

$FK_2O = 3.16\ T - 0.068\ SK$

Where, FN = Nitrogen dose in kg ha^{-1} which is to be added through fertilizer

FP_2O_5= P_2O_5 dose in kg ha^{-1} which is to be added through fertilizer

FK_2O = K_2O dose in kg ha^{-1} which is to be added through fertilizer

T = Yield target in t ha^{-1}

SN = Soil available nitrogen in kg ha^{-1}

SP = Soil available phosphorus in kg ha^{-1}

SK = Soil available potassium in kg ha^{-1}

3.2.1 Treatments

The following six treatments were used in this experiment. The treatment levels and doses are shown below in Table 2. The quantities of fertilizers and manures applied in each treatment are given in Tables 3 and 4.

Table 2. Details of experimental treatments

Treatments	Details of treatments
T_1	Farmer's practice (FP)
T_2	Recommendations of KAU (70: 25: 25 kg ha^{-1} N , P_2O_5, K_2O) (GRD)
T_3	Soil testing laboratory recommendations of Kerala (STL)
T_4	STCR recommendations for a yield target of 30 t ha^{-1} (STCR 1)
T_5	STCR recommendations for a yield target of 45 t ha^{-1} (STCR 2)
T_6	Organics alone (FYM @ 30 t ha^{-1} + groundnut cake @ 1 t ha^{-1} + woodash @ 0.3 t ha^{-1} + pseudomonas @ 10 kg ha^{-1}) (ORG)

Table 3. Rate of application of fertilizers and manures in Pallikkandam field

Treatments	Urea (kg ha^{-1})	Rajphos (kg ha^{-1})	Muriate of potash (kg ha^{-1})	FYM (t ha^{-1})	Ground nut cake (t ha^{-1})	Wood ash (t ha^{-1})	Pseudomonas (kg ha^{-1})
T1	0.00	333.33	0.00	20.00	0.00	0.00	0.00
T2	150.00	138.52	41.00	20.00	0.00	0.00	0.00
T3	146.00	66.00	43.20	20.00	0.00	0.00	0.00
T4	176.00	69.00	149.00	20.00	0.00	0.00	0.00
T5	282.00	206.00	229.00	20.00	0.00	0.00	0.00
T6	0.00	0.00	0.00	30.00	1.00	0.30	10.00

Table 4. Rate of application of fertilizers and manures in Varyathpadi field

Treatments	Urea (kg ha^{-1})	Rajphos (kg ha^{-1})	Muriate of Potash (kg ha^{-1})	FYM (t ha^{-1})	Ground nut cake (t ha^{-1})	Wood ash (t ha^{-1})	Pseudo monas (kg ha^{-1})
T1	0.00	333.33	0.00	20.00	0.00	0.00	0.00
T2	150.00	138.52	41.00	20.00	0.00	0.00	0.00
T3	146.00	49.80	43.16	20.00	0.00	0.00	0.00
T4	169.30	46.48	146.00	20.00	0.00	0.00	0.00
T5	275.50	182.60	225.76	20.00	0.00	0.00	0.00
T6	0.00	0.00	0.00	30.00	1.00	0.30	10.00

3.2.2 Field layout

The lay out of fields and allocation of treatments are shown in the Figures 1 and 2

Fig.1. Allocation of treatments in Pallikandam field

R4	R2
T2	T6
T3	T5
T5	T4
T4	T2
T1	T1
T6	T3

R1	R3
T4	T5
T3	T4
T1	T2
T2	T6
T6	T1
T5	T2

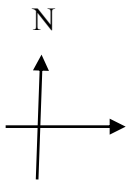
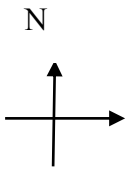


Fig. 2. Allocation of treatments in Varyathpadi field

R2	T1	T5	T4	**R1**	
	T6	T2	T3	T1	T3
R4	T5	T1	T2	T6	T4
	T6	T4	T3	T2	T5
R3	T1	T3	T4		
	T2	T6	T5		



3.2.3 Application of manures and fertilizers

Farm yard manure was applied in the pits as per the treatments as basal dose before sowing the seeds. The fertilizers were also applied as per the treatments. Half of nitrogen, full phosphorus and potassium were applied as basal dose and the remaining half nitrogen at the vining stage of the crop. For organically grown treatment, pseudomonas was applied @ 10 kg ha^{-1} at vining and fruiting stage. Groundnut cake and wood ash were also applied as basal dose. The nutrient content of the fertilizers and manures are given in the Table 5.

Table 5. Nutrient contents of fertilizers and organic manures

Sl.No	Fertilizers	Nutrient Content (%)		
		N	P_2O_5	K_2O
1	Urea	46.00	0.00	0.00
2	Rajphos	0.00	18.00	0.00
3	Muriate of potash	0.00	0.00	60.00
	Organic manure	N	P	K
1	Farm yard manure	1.35	0.52	0.91
2	Groundnut cake	6.7	1.18	1.34
3	Wood ash	0.00	1.57	10.78

3.2.4 Management practices

Management practices like raking, irrigating, spreading dried twigs and weeding etc. were carried out as per the package of practices recommendations for the various treatments (KAU, 2008). In addition, soil drenching and spraying of plant protection chemicals were done whenever necessary.

3.3 Observations recorded

3.3.1 Biometric observations

Biometric observations included length of vine, internodal distance and number of leaves / plant at flowering and harvest stages of the crop. Yield parameters like length and girth of fruits, number of fruits/plant, yield/plant and total dry matter production were recorded at harvest stage of the crop. Keeping quality of the fruit was monitored for a period of three months under ordinary storage conditions and the observations were recorded for rotting percentage of fruit.

3.3.2 Soil analysis

Soil samples were collected from a depth of 0-30 cm and analysed at three stages namely, before the conduct of the experiment, flowering stage and harvest stage of the crop from the various treatment plots. These samples were analysed for texture, pH, EC, CEC, organic carbon, available nitrogen, phosphorus, potassium, calcium, magnesium and iron. The methods adopted are detailed below in Table 6.

Table 6. Methods of soil analysis

Parameter	Method	Reference
Soil texture	International pipette method	Piper (1966)
pH	1: 2.5 soil water suspension - pH meter	Jackson (1958)
Electrical conductivity	1: 2.5 soil water suspension - conductivity meter	Jackson (1958)
Cation exchange capacity	0.1 M $BaCl_2$ extraction method	Handershot and Duquette (1986)
Organic carbon	Wet oxidation method	Walkley and Black (1934)
Available nitrogen	Alkaline permanganate method	Subbiah and Asija (1956)
Available phosphorus	BrayNo.1 extractant method	Bray and Kurtz (1945)
Available potassium	Neutral normal ammonium acetate method	Jakson (1958)
Available calcium	EDTA titration method	Cheng and Bray (1957)
Available iron	0.1 M H Cl extract method	Sims and Johnson (1991)

3.3.3 Plant and fruit analysis

Plant samples were collected by uprooting the plant from each treatment after the harvest of the crop. The fresh weight of the whole plant was recorded after removing the soil. The plant samples were oven dried to constant weight, ground, digested and analysed for the contents, nitrogen, phosphorus, potassium, calcium, magnesium and silicon. Fruit samples were collected fromvarious treatments and they were dried to constant weight and then powdered. These samples were analysed for the content nitrogen, phosphorus, potassium, calcium, magnesium, silicon and also for crude fibre, vitamin A and vitamin C. The methodology adopted to determine the above parameters are detailed below in Table 7.

Table 7. Methods of plant and fruit analysis

Parameter	Method	Reference
Nitrogen	Microkjeldahl distillation method	Jackson (1958)
Phosphorus	Vanado-molybdophosphoric yellow colour method	Jackson (1958)
Potassium	Flame photometer method	Jackson (1958)
Calcium and magnesium	EDTA titration method	Cheng and Bray (1957)
Iron	Di acid extract	Perkin (1974)
Crude silica	Dry ashing	Yoshida *et al*. (1972)
Crude fibre	Acid alkali digestion method	Chopra and Kanwar (1978)
Viamin C	Volumetric method	Sadashivam and Manikkam (1996)
Vitamin A	Optical density measurement	Sadashivam and Manikkam (1996)

3.3.4 Nutrient uptake study

Based on the content of nutrients in the plant and fruit, the uptake was computed.

3.4 Economic analysis of treatments

The cost of various inputs and the prevailing labour charge in the locality were taken together and gross expenditure was computed and expressed in rupees per hectare. The price of fruits at current local market was taken as total receipts for computing gross returns and expressed in rupees per hectare. Benefit : cost ratio was worked out by dividing the gross return with total expenditure per hectare. The details of market prices are furnished in Table 8.

Table 8. Details of market prices of inputs and produce

Items	Cost (Rs kg^{-1})
Urea	5.20
Rajphos	4.60
Muriate of potash	4.80
Ground nut cake	25.00
Wood ash	2.00
Farm yard manure	1.00
Pseudomonas	50.00
Fruit (organic)	9.00
Fruit (fertilizer applied)	6.00
Labour and other costs (Rs ha^{-1})	50000.00

3.5 Statistical analysis

Data were subjected to analysis of variance using statistical package 'MSTAT –C' package (Freed, 2006). Whenever the F test was significant (at 5% level) multiple comparisons among the treatment means were done with Duncan's Multiple Range test (DMRT). Correlation studies of data were carried out using SPSS package and path analysis was done using SAS package. Path coefficient values were compared with the standard table (Table 9). The yield prediction equation was developed by non linear procedure using SAS system and the mode of iteration was Gauss- Newton.

Table 9. Path coefficient comparison table

Range of value	Group
0.00 – 0.09	Negligible
0.10 – 0.19	Low
0.20 – 0.29	Moderate
0.30 – 0.99	High
> 1.00	Very high

Results

4. RESULTS

Soil testing provides information regarding the nutrient requirements of crop under study and the yield limiting nutrients. Field experiments are being undertaken to find out the correlation between soil test values and crop response to fertilizers. The present study was undertaken to test verify the STCR equations developed by Kerala Agricultural University for the crop, Oriental pickling melon (Cucumis *melo* V. Conomon) and to study the various nutrient interactions in the crop. The field experiment consisted of the farmer's field trial at two locations in Pattikkad area of Thrissur district. The related results are presented in this chapter.

4.1 Fertility status of the experimental area

The yield of the crop is assumed to be a function of soil fertility and applied fertilizers irrespective of other yield limiting factors. In this study, the original fertility status of the soil at two locations were determined (Table 1) and based on these values, the quantity of feritlizers required for the crop for yield targets of 30 and 45 t ha^{-1} of fruit yield were calculated (Tables 3 and 4). The content of available N, P, K and organic carbon were taken to calculate the quantity of fertilizers to be applied (Table 10).

Table 10. Basic fertility status of the fields

Fields	Organic C (%)	Available nutrients (kg ha^{-1})		
Pallikkandam		N	P	K
	0.65	164.12	27.57	75.72
Varyathpadi	0.72	194.11	30.52	91.52

4.2 Field verification trials

The field trials were conducted in two locations at Pattikkad area of Thrissur district. The soil, plant and fruit analysis data are given in appendix tables.

The quantity of fertilizers required for the treatment T_4, STCR recommendation for target of 30 t ha^{-1} yield, was calculated as per the STCR targeted yield equations. The quantities applied were 176.00, 69.00 and 149.00 kg ha^{-1} of urea, rajphos and muriate of potash respectively. Similar method was followed in the fifth treatment, T_5 for a targeted yield of 45 t ha^{-1}. Here the quantities of fertilizers applied were 282.00, 206.00 and 229.00 kg ha^{-1} of urea, rajphos and muriate of potash respectively. In all the treatments except T_6, FYM @ 20 t ha^{-1} was applied. In T_6, FYM was applied @ 30 t ha^{-1}

4.3 Biometric observations and yield parameters

The data on biometric observations on vegetative growth character (length of vine, internodal distance and number of leaves) at the flowering and harvesting stages of the crop are furnished in Tables 11 and 12. The data on yield parameters (length of fruit, girth of fruit, number of fruits / plant, dry matter production and rotting percentage) are furnished in Tables 13 and 14.

4.3.1 Length of vine

At the flowering stage, the treatments showed a significant variation in the length of vine (m) in both the locations. In Pallikkandam, the maximum value was observed in the treatment, T_4 (2.47) and the minimum value in T_1 (0.70). All other treatments were on par. The significant difference observed was in the order of T_4 (2.47), T_5 (1.80), T_6 (1.62), T_2 (1.45), T_3 (1.07) and T_1 (0.70). In Varyathpadi, the maximum value of 1.90 was observed in the treatment, T_4 and the minimum value in the treatment T_1 (0.46).

Table 11. Effect of treatment on vegetative growth of the crop in Pallikandam

	Flowering stage			Harvest stage		
Treatment	Length of vine (m)	Internodal distance (cm)	Number of leaves per plant	Length of vine (m)	Internodal distance (cm)	Number of leaves per plant
1	0.71^{c}	8.25^{c}	62.00^{a}	1.2^{c}	8.25^{c}	95.00^{c}
2	1.45^{b}	10.00^{ab}	114.8^{c}	2.3^{b}	10.11^{ab}	14.3^{b}
3	1.07^{b}	10.50^{ab}	123.3^{bc}	2.5^{b}	10.51^{ab}	149.3^{b}
4	2.47^{a}	11.00^{a}	166.0^{a}	3.5^{c}	11.00^{a}	184.0^{a}
5	1.80^{b}	10.00^{ab}	133.8^{b}	2.6^{b}	10.00^{ab}	150.5^{b}
6	1.62^{b}	9.25^{bc}	121.5^{bc}	2.4^{b}	9.25^{bc}	137.0^{b}
CD (5%)	0.37	1.48	17.21	0.38	1.48	14.22

Table 12. Effect of treatment on vegetative growth of the crop in Varyathpadi

	F lowering stage			Harvest stage		
Treatment	Length of vine (m)	Internodal distance (cm)	Number of leaves per plant	Length of vine (m)	Internodal distance (cm)	Number of leaves per plant
1	0.46^{d}	8.00^{b}	34.7^{d}	0.81^{d}	8.03^{b}	47.0^{d}
2	1.15^{c}	10.25^{a}	89.5^{c}	1.9^{c}	10.25^{a}	101.8^{c}
3	1.50^{b}	10.25^{a}	94.7^{c}	2.5^{b}	10.25^{a}	116.3^{bc}
4	1.90^{a}	10.5^{a}	117.8^{a}	3.1^{a}	10.50^{a}	136^{a}
5	1.55^{b}	10.25^{a}	102.1^{b}	2.4^{b}	10.25^{a}	119.3^{b}
6	1.22^{c}	10.50^{a}	90.7^{c}	1.9^{c}	10.50^{a}	102.8^{c}
CD (5%)	0.2	1.67	19	0.31	1.65	14.85

At harvest stage, the treatments showed a significant variation in both the fields in the length of vine (m). In Pallikkandam, the maximum value was observed in the treatment T_4 (3.50) and the minimum value in the treatment T_1 (1.20). In Varyathpadi, the maximum value of 3.10 was noticed in the treatment T_4 and the minimum value of 0.81 in the treatment T_1.

4.3.2 Internodal distance

At flowering stage, the treatments showed a significant difference in both the fields in inter nodal distance (cm). In Pallikkandam, the data showed maximum value of 11.00 in the treatment T_4 and the minimum value of 8.25 in the treatment T_1. In Varyathpadi, the values for the treatments showed the maximum value of 10.5 in the treatments T_4 and T_6. The minimum value of 8.00 was observed in the treatment T_1.

At harvest stage, significant difference was observed in inter nodal distance between the treatments at both the locations. In Pallikkandam, the maximum value of 11.00 was observed in the treatment T_4 and the minimum value of 8.25 in the treatment T_1. In Varyathpadi, the maximum value of 10.5 was observed in the treatment T_4 and the minimum value of 8.03 in the treatment T_1.

4.3.3 Number of leaves

At flowering stage, the treatments showed a significant variation in the number of leaves in both the locations. In Pallikkandam, the maximum value of 166.00 was noticed in treatment T_4 and the minimum value of 62.00 in the treatment T_1. In Varyathpadi, the maximum value of 117.8 was noticed in treatment T_4 and the minimum value of 34.70 in the treatment T_1.

At the harvest stage, the treatments showed significant variation in the number of leaves at both the locations. In Pallikkandam, the maximum value of 184.00 was shown by the treatment T_4 and the minimum value of 95.00 by the

Table 13. Effect of treatment on yield parameters of the crop in Pallikandam

Treatments	Length of fruit (cm)	Girth of fruit (cm)	Number of fruits/plant	Yield/plant (kg)	Rotting (%)	Yield (kg ha^{-1})
1	15.25^{d}	15.55^{d}	1.25^{c}	0.32^{f}	31.01^{d}	1372^{e}
2	26.08^{c}	36.35^{c}	2.75^{ab}	1.68^{c}	32.22^{c}	16750^{c}
3	30.25^{b}	31.27^{b}	2.75^{ab}	1.52^{d}	45.51^{b}	13970^{d}
4	34.42^{a}	34.33^{a}	3.50^{a}	2.75^{a}	62.25^{a}	26560^{a}
5	32.75^{ab}	32.31^{b}	3.01^{ab}	2.03^{b}	65.51^{a}	20510^{b}
6	26.33^{c}	26.27^{c}	2.02^{bc}	1.12^{e}	36.51^{e}	12910^{d}
CD (5%)	2.6	1.33	1.03	0.14	3.3	1143

Table 14. Effect of treatment on yield parameters of the crop in Varyathpadi

Treatments	Length of fruit(cm)	Girth of fruit (cm)	Number of fruits/plant	Yield/plant (kg)	Rotting (%)	Yield (kg ha^{-1})
1	20.50^{d}	20.31^{e}	1.25^{c}	0.12^{e}	33.02^{c}	974^{e}
2	23.33^{c}	23.45^{d}	2.25^{ab}	1.32^{c}	36.11^{c}	12520^{d}
3	28.23^{b}	27.52^{c}	1.75^{bc}	1.26^{c}	44.25^{b}	12630^{d}
4	34.30^{a}	32.58^{a}	2.25^{ab}	2.16^{a}	65.01^{a}	22520^{a}
5	30.4^{b}	31.05^{b}	2.03^{ab}	1.61^{b}	68.75^{a}	16150^{b}
6	25.50^{c}	24.25^{b}	2.75^{a}	0.96^{d}	36.25^{d}	10510^{d}
CD (5%)	2.52	0.92	0.7	0.12	4.96	1035

treatment T_1. In Varyathpadi, the maximum value of 136.00 was observed in the treatment T_4 and the minimum value of 47.00 in the treatment T_1.

4.3.4 Length of fruit

There was significant difference between the treatments for the length of fruit (cm) in both the fields. In Pallikkandam, the longest fruit was observed in the treatment T_4 (34.42) and the shortest fruit was in the treatment T_1 (15.25). In Varyathpadi, the longest fruit was observed in the treatment T_4 (34.30) and the shortest fruit was in the treatment T_1 (20.50).

4.3.4 Girth of fruit

There was significant difference between the treatments for this character in both the locations. In Pallikkandam, the maximum girth (cm) was observed in the treatment T_4 (34.33) and the minimum in the treatment T_1 (15.55). In Varyathpadi, the maximum girth was observed in the treatment T_4 (32.58) and the minimum in the treatment T_1 (20.31).

4.3.5 Number of fruits per plant

There was significant difference for this character in both the locations. In Pallikkandam, the highest number of fruits per plant (nos) was observed in the treatment T_4 (3.50) and the minimum number in the treatment T_1 (1.25). . In Varyathpadi, the highest number of fruits per plant was observed in the treatment T_6 (2.75) and the minimum number in the treatment T_1 (1.25).

4.3.6 Yield per plant

There was significant difference between the treatments in this character. In Pallikkandam, the highest yield (kg) was observed in the treatment T_4 (2.75) and the lowest yield in the treatment T_1 (0.32). In Varyathpadi, the highest yield was observed in the treatment T_4 (2.16) and the lowest yield in the treatment T_1 (0.12).

Observations on fruit yield in Pallikkandam showed that the highest yield of 26560 kg ha^{-1} was obtained in the treatment T_4, which received 20 t ha^{-1} of FYM, 176, 69 and 149 kg ha^{-1} of urea, rajphos and muriate of potash. The average yield was 26560, 20510, 16750, 13970, 12910 and1372 kg ha^{-1} for T_4, T_5, T_2, T_3, T_6 and T_1 respectively. The lowest yield recorded was in the treatment which received 20 t ha^{-1} FYM and 333.33 kg ha^{-1} rajphos. Observations on fruit yield in Varyathpadi showed that the highest yield was observed in the treatment, T_4 (22520 kg ha^{-1}) and the lowest in T_1 (974 kg ha^{-1}). The average yield was 22520, 16150, 12630, 12520, 10510 and 974 kg ha^{-1} for T_4, T_5, T_3, T_2, T_6 and T_1 respectively.

4.3.7 Rotting percentage of fruits

There was significant difference between the treatments for rotting percentage in both the fields. In Pallikkandam, the highest rotting percentage (65.51%) was observed in the treatment T_5 and the lowest (31.01%) in the treatment T_1. In Varyathpadi, the highest rotting percentage (68.75 %) was observed in the treatment T_5 and the lowest (33.02%) in the treatment T_2.

4.4 Soil analysis

4.4.1 Soil nutrient status at flowering stage

Soil samples were drawn at the flowering stage of the crop from all the treatments and analysed for the nutrients like organic carbon, available N, P, K, Ca, Fe and the physico chemical properties like pH, EC and CEC. The data are given in the Tables 15 and 16.

Data on pH indicated that there was no significant difference between the treatments in Pallikkandam, but in Varyathpadi, the treatments T_6 and T_1 showed significance over T_5, T_4, T_2, and T_3 and the values were 4.97, 4.95, 4.65, 4.60, 4.55 and 4.50 respectively.

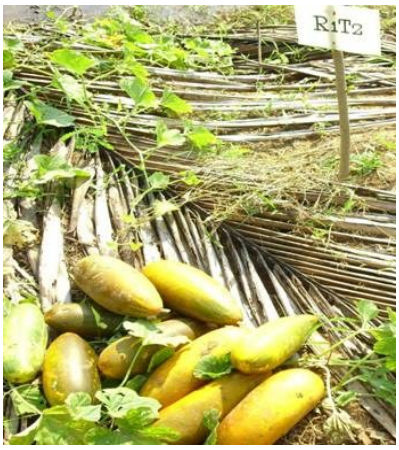


Plate 3. General view of yield difference between the treatments in Pallikandam

Plate 4. General view of yield difference between treatments in Varyathpadi

Data on EC indicated that at both the locations, the treatment T_4 was superior. In Pallikkandam, T_4 was followed by T_2, T_5, T_1, T_6 and T_3 and in Varyathpadi, T_4 was followed by T_3, T_5, T_1, T_2 and T_6 respectively. The values were 0.06, 0.05, 0.05, 0.04, 0.03and 0.02 d Sm^{-1} respectively in Pallikkandam and 0.05, 0.04, 0.04, 0.03, 0.03, 0.03 d S m^{-1} respectively in Varyathpadi.

Data on CEC showed no significant difference among the treatments in Varyathpadi. In Pallikkandam, the treatment T_3 was found to be highly significant followed by T_4, T_6, T_5, T_2 and T_1 and the values were 4.65, 4.35, 4.12, 4.05, 3.97 and 3.90 cmol (p^+) kg^{-1} respectively.

In Pallikkandam, organic carbon content (%) varied from 1.20 to 1.44 with the maximum in the treatment T_5 and the minimum in the treatment T_1. In Varyathpadi, organic carbon content varied from 1.14 to 1.30 with a maximum in the treatment $T_5$and the minimum in the treatment T_3. There was no significant difference between the treatments.

In Pallikkandam, available nitrogen content (kg ha^{-1}) varied from 544.88 to 703.47 with the maximum value in the treatment T_3 and the minimum treatment T_1. In Varyathpadi, nitrogen content varied from 366.20 to 599.21 with the maximum value in T_5 and the minimum in the treatment T_3. There was no significant difference between the treatments in Pallikkandam.

There was significant difference between the treatments for available phosphorus (kg ha^{-1}) in the fields. In Pallikkandam, available phosphorus content varied from17.68 to 23.80 with the maximum value of 23.80 in the treatment T_4 and the lowest in the treatment T_3. In Varyathpadi, phosphorus content varied from 20.62 to 25.74 with the maximum in the treatment T_5 and the minimum in treatment T1.

Table 15 Effect of treatment on soil properties at the flowering stage of the crop in Pallikandam

Treatments	pH	EC (dS m^{-1})	CEC (cmol kg^{-1})	Organic C (%)	Available nutrients (kg ha^{-1})				
					N	P	K	Ca	Fe
1	5.05^{a}	0.04^{bc}	3.90^{c}	1.20^{c}	544.88^{a}	21.03^{ab}	369.25^{c}	77.22^{a}	92.34^{a}
2	5.12^{a}	0.05^{ab}	3.97^{bc}	1.31^{abc}	642.88^{a}	18.33^{b}	629.80^{b}	65.01^{a}	99.17^{a}
3	5.07^{a}	0.02^{d}	4.65^{a}	1.27^{bc}	703.47^{a}	17.68^{b}	676.80^{b}	68.04^{a}	114.62^{a}
4	4.97^{a}	0.06^{a}	4.35^{ab}	1.36^{ab}	595.84^{a}	23.80^{a}	428.20^{c}	53.89^{a}	94.46^{a}
5	5.07^{a}	0.05b	4.05^{bc}	1.44^{a}	548.80^{a}	22.92^{a}	853.70^{a}	55.04^{a}	94.21^{a}
6	5.45^{a}	0.03^{cd}	4.12^{bc}	1.29^{bc}	690.10^{a}	20.88^{ab}	707.20^{b}	64.14^{a}	102.39^{a}
CD (5%)	NS	0.01	0.37	0.14	NS	3.69	142	NS	NS

Table 16. Effect of treatment on soil properties at the flowering stage of the crop in Varyathupadi

Treatments	pH	EC (dS m^{-1})	CEC (cmol kg^{-1})	Organic C (%)	Available nutrients (kg ha^{-1})				
					N	P	K	Ca	Fe
1	4.95^{a}	0.03^{b}	4.20^{a}	1.25^{a}	461.40^{b}	20.62^{c}	138.03^{c}	69.21^{a}	125.80^{a}
2	4.55^{b}	0.03^{b}	4.55^{a}	1.26^{a}	532.30^{ab}	23.22^{abc}	410.91^{bc}	59.31^{a}	87.60^{b}
3	4.50^{b}	0.04^{ab}	4.45^{a}	1.14^{a}	366.20^{c}	22.24^{bc}	380.21^{bc}	52.58^{a}	98.17^{ab}
4	4.60^{b}	0.05^{a}	4.27^{a}	1.23^{a}	548.90^{ab}	24.67^{ab}	253.76^{bc}	65.63^{a}	128.40^{a}
5	4.65^{b}	0.04^{ab}	3.92^{a}	1.30^{a}	599.21^{a}	25.74^{a}	897.15^{a}	46.18^{a}	124.60^{a}
6	4.97^{a}	0.03^{b}	4.65^{a}	1.17^{a}	483.33^{abc}	22.88^{abc}	559.90^{b}	64.79^{a}	108.80^{ab}
CD (5%)	0.2	0.01	NS	NS	89.33	3.15	285	NS	27.76

Available potassium showed significant difference between the treatments. In Pallikkandam, available potassium (kg ha^{-1}) content varied from 369.25 to 853.70 with the maximum in the treatment T_5 and the minimum in T_1. In Varyathpadi, available potassium content varied from 138.00 to 897.15 with the maximum in T_5 and the minimum in T_1.

In Pallikkandam, available calcium content (kg ha^{-1}) varied between 55.89 to 77.22 with the maximum in the treatment T_1 and the minimum in T_4. In Varyathpadi, available calcium content varied between 46.18 to 69.21 with the maximum in the treatment T_1 and the minimum in T_5. There was no significant difference between the treatments in both the fields with respect to the content of Ca.

In Pallikkandam, available iron (kg ha^{-1}) varied from 92.34 to 114.62 with the maximum in the treatment T_3 and the minimum in T_1. In Varyathpadi, available iron varied from 87.60 to 128.40 with the maximum in treatment T_4 and the minimum in T_2.

4.4.2 Soil nutrient status at harvest stage

Soil samples were collected at the harvest stage of oriental pickling melon from all the treatments and analysed for the nutrients like organic carbon, available nitrogen, phosphorus, potassium, calcium, and iron and the physico chemical properties like pH, EC and CEC of the soil. The data observed are given in the Tables 17 and 18.

The data on pH showed significant difference in Pallikkandam only. The highest value was recorded in the treatment, T_1 (5.05) and the lowest value was observed in the treatment, T6 (3.20). The data on EC and CEC did not show any significant difference between the various treatments in both the fields. The data on organic carbon did not show significant difference between the treatments in fields 1 and 2.

The average values for available nitrogen in Pallikkandam were 269.8, 239.04, 234.90, 231.02, 225.92, and 224.59 kg $ha^{-1}$for T_5, T_3, T_6, T_2, T_1 and T_4 respectively. In Varyathpadi, the values for available nitrogen were 272.97, 264.30, 261.02, 236.65, 233.60 and 200.50 kg ha^{-1} for T_4, T_1, T_5, T_2, T_3 and T_6 respectively. There was no significant difference between the treatments in both the fields.

There was significant difference between the treatments in the content of available phosphorus (kg ha^{-1}). In Pallikkandam, the highest available phosphorus (26.80) was observed in the treatment T_4 and the lowest (15.23) in the treatment T_6. In Varyathpadi the maximum value (31.33) was recorded in the treatment T_6 and the minimum (23.36) in the treatment T_3.

There was significant difference between the treatments in the content of available potassium (kg ha^{-1}). In Pallikkandam, the maximum value (370.94) was observed in the treatment T_4 and the minimum (225.60) in the treatment T_3. In Varyathpadi, the maximum value (332.10) was recorded in the treatment T_5 and the minimum (241.50) in the treatment T_3.

There was no significant difference between the treatments in the content of available Ca (kg ha^{-1}) in both the fields. In the case of available calcium, the values were 57.68, 52.92, 60.56, 49.56, 58.24 and 54.71 for T_1, T_2, T_3, T_4, T_5 and T_6 respectively in Pallikkandam. In Varyathpadi, available Ca values were 55.16, 59.30, 52.58, 48.04, 40.54, and 49.61 for T_1, T_2, T_3, T_4, T_5 and T_6 respectively.

In the case of available Fe (kg ha^{-1}), the values were 115.86, 115.30, 108.13, 116.31, 116.48 and 117.82 for T_1, T_2, T_3, T_4, T_5 and T_6 respectively in Pallikkandam. In Varyathpadi, available Fe values were 125.77, 93.71, 108.69, 131.76, 126.39 and 117.37 for T_1, T_2, T_3, T_4, T_5 and T_6 respectively. There was no significant difference between the treatments in the case of available Fe.

Table 17. Effect of treatment on soil properties at the harvest stage of the crop in Pallikandam

Treatments	pH	EC (dSm^{-1})	CEC (C mol kg^{-1})	Organic C (%)	Available nutrients (kg ha^{-1})				
					N	P	K	Ca	Fe
1	5.05^{ab}	0.04 ^{a}	4.32^{a}	1.39^{a}	225.92^{a}	24.03 ^{a}	273.9^{c}	57.68^{a}	115.86^{a}
2	4.95^{abc}	0.02^{a}	4.45 ^{a}	1.99^{a}	231.02^{a}	24.01^{a}	255.2^{cd}	52.92 ^{a}	115.3^{a}
3	4.42^{c}	0.05^{a}	4.25^{a}	1.51^{a}	239.04 ^{a}	26.67^{a}	225.6^{d}	60.56 ^{a}	108.13^{a}
4	4.70^{bc}	0.03^{a}	3.82^{a}	2.11^{a}	224.59^{a}	26.80^{a}	370.9^{a}	49.56 ^{a}	116.31^{a}
5	4.77^{abc}	0.03^{a}	4.60 ^{a}	2.01^{a}	269.80^{a}	23.88^{a}	288.2^{bc}	58.24 ^{a}	116.48^{a}
6	3.20^{a}	0.04^{a}	4.60 ^{a}	1.68^{a}	234.90^{a}	15.23^{a}	313.6^{b}	54.71^{a}	117.82^{a}
CD (5%)	0.44	NS	NS	NS	NS	3.84	35.74	NS	NS

Table 18. Effect of treatment on soil properties at the harvest stage of the crop in Varyathupadi

Treatments	pH	EC (dSm^{-1})	CEC (C mol kg^{-1})	Organic C (%)	Available nutrients (kg ha^{-1})				
					N	P	K	Ca	Fe
1	5.07 ^{a}	0.03^{a}	4.10 ^{a}	1.86$^{a.}$	264.30^{a}	26.43 ^{a}	252.7^{cd}	55.16^{a}	125.77^{a}
2	4.67^{a}	0.04 ^{a}	4.32^{a}	1.83^{a}	236.65^{a}	23.67^{ab}	252.3^{cd}	59.30^{a}	93.71^{a}
3	4.65 ^{a}	0.02^{a}	3.97^{a}	2.01^{a}	233.6^{a}	23.36^{ab}	241.1^{d}	52.58^{a}	108.69^{a}
4	4.55 ^{a}	0.05^{a}	4.75 ^{a}	1.82^{a}	272.97^{a}	27.30^{a}	315.4^{ab}	48.04^{a}	131.76^{a}
5	4.92^{a}	0.03 ^{a}	3.80 ^{a}	1.93^{a}	261.02^{a}	28.83^{bc}	332.1^{a}	40.54^{a}	126.39^{a}
6	5.17^{a}	0.04 ^{a}	4.325 ^{a}	1.69^{a}	200.50^{a}	31.33^{b}	283.1^{bc}	49.61^{a}	117.37^{a}
CD (5%)	NS	NS	NS	NS	NS	2.49	36	NS	NS

4.5 Plant analysis

After the harvest of the crop, the whole plant was uprooted from each treatment and nutrient analysis was done. The data is given in the Tables 19 and 20.

There was significant difference between the treatments for the total nitrogen content in both the fields. In Pallikkandam, the total N content (%) for the different treatments showed the maximum (1.43) in the treatment T_4 and the minimum (0.96) in the treatment T_6. In Varyathpadi, the total N content (%)for the different treatments showed the maximum (1.33) in the treatment T_4 and the minimum (0.95) in the treatment T_6.

There was significant difference for total P (%) content of the plant between the different treatments. In Pallikkandam, the total P content varied between 0.30 (T_6) and 0.34 (T_4). In Varyathpadi, the P content (%) varied between 0.29 (T_2) and 0.36 (T_4).

There was significant difference between the treatments for the total K content of plant. In Pallikkandam, the values for the total K content (%) showed the maximum value of 7.73 in the treatment T_4 and the minimum of 2.45 in the treatment T_1. In Varyathpadi, the total K content (%) showed the maximum (8.82) in the treatment T_4 and the minimum (2.16) in the treatment T_1.

A significant difference was observed between the treatments for the total calcium content of the plant. In Pallikkandam, the Ca content (%) varied between 0.0024 (T_1) and 0.0035 (T_5). In Varyathpadi, the Ca content (%) varied between 0.0017 (T_6) and 0.0035 (T_5).

Table 19 Effect of treatment on plant nutrient content (%)in Pallikandam

Treatments	N (%)	P(%)	K (%)	Ca (%)	Mg (%)	Si (%)
1	1.00^{de}	0.30^{c}	2.45^{d}	0.0024^{a}	0.0018^{a}	1.17^{a}
2	1.04^{d}	0.32^{b}	4.02^{c}	0.0026^{a}	0.0019^{a}	0.69^{a}
3	1.23^{c}	0.30^{c}	5.62^{b}	0.0030^{a}	0.0021^{a}	0.81^{a}
4	1.43^{a}	0.34^{a}	7.73^{a}	0.0027^{a}	0.0015^{a}	1.36^{a}
5	1.32^{b}	0.32^{b}	7.65^{a}	0.0035^{a}	0.0014^{a}	1.36^{a}
6	0.96^{e}	0.30^{c}	5.75^{b}	0.0028^{a}	0.0015^{a}	1.36^{a}
CD (5%)	0.06	0.01	0.23	0.001	0.001	NS

Table 20. Effect of treatment on plant nutrient content (%) Varyathpadi

Treatments	N	P	K	Ca	Mg	Si
1	1.02^{b}	0.304^{b}	2.16^{d}	0.0026^{a}	0.0018^{a}	0.86^{a}
2	1.26^{a}	0.29^{b}	4.90^{c}	0.0023^{a}	0.0014^{a}	0.63^{a}
3	1.26^{a}	0.29^{b}	5.52^{b}	0.0024^{a}	0.0009^{a}	0.46^{a}
4	1.33^{a}	0.36^{b}	8.82^{a}	0.0027^{a}	0.0002^{a}	0.52^{a}
5	1.32^{a}	0.33^{b}	7.67^{a}	0.0035^{a}	0.0015^{a}	1.11^{a}
6	0.95^{b}	0.30^{b}	5.57^{b}	0.0017^{a}	0.0016^{a}	0.71^{a}
CD (5%)	0.09	0.4	0.57	0.001	0.001	NS

A significant difference was observed between the treatments for the total Mg (%) content of the plant. In Pallikkandam, the values for Mg content varied between 0.0014 (T_5) and 0.0021 (T3). In Varyathpadi, the values for Mg content varied between 0.0002 (T_4) and 0.0018 (T1).

No significant difference was observed between the treatments for the crude silica content of the plant. In Pallikkandam, the average value for crude silica content (%) varied between 0.69 (T_2) and 1.36 (T_4, T_5 and T_6). In Varyathpadi, the average value for crude silica content (%) varied between 0.46 (T_3) and 1.11 (T_5).

4.6 Fruit sample analysis

The fruit samples were analysed for their nutrient content and the average data are given in the Tables 21 and 22.

There was significant difference between the treatments for the total nitrogen content of fruit sample in both the fields. In Pallikkandam, the average values for the total N content (%) showed the maximum value of 0.73 in the treatment T_4 and the minimum value of 0.45 in the treatment T_2. In Varyathpadi, the average values for the total N content (%) showed the maximum value of 0.67 in the treatment T_4 and the minimum value of 0.40 in the treatment T_6.

There was significant difference between the treatments for the total P content of the fruit. In Pallikkandam, the values for the total P content (%) among the different treatments showed the maximum of 0.55 in the treatment T_4 and the minimum of 0.16 in the treatment T_6. In Varyathpadi, the average values for the total P content (%) showed the maximum of 0.56 in the treatment T_4 and the minimum of 0.21 in the treatment T_6.

A significant difference was observed for total K content (%) of the fruit between the different treatments. In Pallikkandam, the total K content varied between 2.50 (T_6) and 4.51 (T_2) and in Varyathpadi, the average K content varied between 3.25 (T_1) and 4.34 (T4).

A significant difference was observed between the treatments for the total Ca content (%) of the fruit. In Pallikkandam, the Ca content varied between 0.0023 (T_1) and 0.0033 (T_5). In Varyathpadi, the Ca content varied between 0.0019 (T_2) and 0.0077 (T5).

A significant difference was observed between the treatments for the total magnesium content of the fruit. In Pallikkandam, the values for Mg content (%) varied between 0.0008 (T_3) and 0.0016 (T5). In Varyathpadi, the values for Mg content varied between 0.0003 (T_5) and 0.0004 (T_1, T_2, T_3, T_4 and T_6).

In Pallikkandam, there was a significant difference between the treatments for the total Fe (%) content. The maximum was observed in the treatments T_5 and T_1 (0.0007) and the minimum in the treatment T_3 (0.0003). In Varyathpadi, there was no significant difference between the treatments. The values were between 0.0002 (T3) and 0.0005 (T_6). A large and significant difference was observed between the different treatments for the crude silica content (%) of the fruit. In Pallikkandam, the crude silica content varied between 0.18 (T_6) and 0.69 (T_5). In Varyathpadi, the values varied between 0.08 (T_6) and 0.55 (T_5).

There was no significant difference observed between the treatments for the vitamin A content (%) of the fruit. In Pallikkandam, the average values were between 0.0003 (T_2 and T_3) and 0.0006 (T6). In Varyathpadi, the average values were between 0.0003 (T_1) and 0.0007 (T_5).

Table 21. Effect of treatment on the nutrient content of fruit (%) in Pallikandam

Treatments	N	P	K	Ca	Mg	Fe	Vitamin A	Vitamin C	Crude fibre	Si
1	0.47^{b}	0.51^{a}	3.65^{cd}	0.0023^{a}	0.0011^{a}	0.0007^{a}	0.0004^{a}	0.013 ^{a}	16.0^{a}	0.31^{bc}
2	0.45^{b}	0.38^{b}	4.51^{a}	0.0027^{a}	0.0009^{a}	0.0004^{a}	0.0003^{a}	0.014 ^{a}	17.6^{a}	0.38^{bc}
3	0.51^{b}	0.35^{b}	3.96^{bc}	0.0027^{a}	0.0008^{a}	0.0003^{a}	0.0003^{a}	0.017 ^{a}	13.2^{b}	0.46^{b}
4	0.73^{a}	0.55^{a}	4.34^{ab}	0.0032^{a}	0.0011^{a}	0.0006^{a}	0.0004^{a}	0.016 ^{a}	11.0^{c}	0.69^{a}
5	0.66^{a}	0.54^{a}	3.40^{d}	0.0033^{a}	0.0016^{a}	0.0007^{a}	0.0004^{a}	0.017 ^{a}	13.5^{b}	0.45^{b}
6	0.50^{b}	0.16^{c}	2.50^{e}	0.0026^{a}	0.0015^{a}	0.0005^{a}	0.0006^{a}	0.015 ^{a}	15.7^{a}	0.18^{c}
CD (5%)	0.08	0.08	0.38	0.01	0.01	0.01	NS	0.01	1.42	0.21

Table 22. Effect of treatment on the nutrient content of fruit (%) in Varyathpadi

Treatments	N	P	K	Ca	Mg	Fe	Vitamin A	Vitamin C	Crude fibre	Si
1	0.48^{b}	0.49^{b}	3.25^{c}	0.0023^{a}	0.0004^{a}	0.0004^{a}	0.0003^{a}	0.014^{a}	15.2^{a}	0.22^{c}
2	0.48^{b}	0.36^{c}	4.21^{a}	0.0019^{a}	0.0004^{a}	0.0004^{a}	0.0005^{a}	0.017 ^{a}	16.0^{a}	0.29^{a}
3	0.52^{b}	0.35^{c}	3.61^{bc}	0.0026^{a}	0.0004^{a}	0.0002^{a}	0.0005^{a}	0.016 ^{a}	14.5^{b}	0.40^{b}
4	0.67^{a}	0.56^{a}	4.34^{a}	0.0028^{a}	0.0004^{a}	0.0004^{a}	0.0005^{a}	0.017 ^{a}	13.2^{b}	0.40^{b}
5	0.65^{a}	0.37^{bc}	3.96^{ab}	0.0077^{a}	0.0003^{a}	0.0003^{a}	0.0007^{a}	0.014 ^{a}	14.0^{ab}	0.55^{a}
6	0.40^{b}	0.21^{d}	3.97^{ab}	0.0022^{a}	0.0004^{a}	0.0005^{a}	0.0004^{a}	0.014 ^{a}	14.7^{ab}	0.08^{d}
CD (5%)	0.09	0.11	0.51	0.01	0.01	NS	NS	NS	1.73	0.12

In Pallikkandam, there was a significant difference between the treatments for the ascorbic acid (vitamin C) content (%) of the fruit. The maximum value was observed in the treatments T_3 and T_5 (0.017) and the minimum value in the treatment T_1 (0.013). In Varyathpadi, there was no significant difference observed between the treatments. The values were between 0.014 (T1, T_5 and T_6) and 0.017 (T_2 and T_4).

There was significant difference between the treatments for the crude fibre content (%) of the fruit. In Pallikkandam, the values for the different treatments showed the maximum value of 17.60 in the treatment T_2 and the minimum value of 11.00 in the treatment T_4. In Varyathpadi, the crude fibre content showed the maximum (16.00) in the treatment T_2 and the minimum (13.2) in the treatment T_4.

4.7 Nutrient uptake by oriental pickling melon

The nutrient uptake of oriental pickling melon was calculated separately for the plant (vine + root +leaf) and fruit for all the treatments. The total uptake (kg ha^{-1}) is represented in the Table 23.

There was significant difference between the treatments for the nitrogen uptake (kg ha^{-1}) in both the fields. In Pallikkandam, the values for the nitrogen uptake showed the maximum value of 12.09 in the treatment T_4 and the minimum value of 1.54 in the treatment T_1. In Varyathpadi, the maximum value was 9.21 in the treatment T_4 and the minimum was 1.29 in the treatment T_1.

The uptake of phosphorus (kg ha^{-1}) showed significant difference between the treatments in both the fields. In Pallikkandam, the values for the P uptake showed the maximum value of 6.45 in the treatment T_4 and the minimum value of 0.67 in the treatment T_1. In Varyathpadi, the maximum value was 5.45 in the treatment T_4 and the minimum value of 0.52 in the treatment T_1.

Table 23. Effect of treatment on the nutrient uptake (kg ha^{-1}) of the crop in Pallikkandam

Treatments	N	P	K	Ca	Mg	Si
1	1.54^{d}	0.674^{e}	5.22^{e}	0.0044^{d}	0.0036^{b}	1.65^{c}
2	5.89^{c}	3.09^{b}	39.81^{c}	0.0238^{bc}	0.0117^{a}	3.95^{b}
3	6.53^{c}	3.04^{b}	40.37^{c}	0.0271^{abc}	0.0112^{a}	9.83^{ab}
4	12.09^{a}	6.45^{a}	69.75^{a}	0.0407^{a}	0.0150^{a}	6.47^{a}
5	9.62^{b}	5.71^{a}	52.34^{b}	0.0375^{ab}	0.0217^{a}	4.89^{ab}
6	4.56^{c}	1.45^{c}	24.06^{d}	0.0186^{cd}	0.0120^{a}	3.36^{b}
CD (5%)	0.7	0.21	12.05	0.01	0.01	1.1

Table 24. Effect of treatment on the nutrient uptake (kg ha^{-1}) of the crop in Varyathpadi

Treatments	N	P	K	Ca	Mg	Si
1	1.29^{e}	0.52^{d}	3.71^{d}	0.0036^{b}	0.0024^{a}	1.01^{e}
2	4.61^{d}	2.28^{b}	29.55^{c}	0.0135^{ab}	0.0084^{a}	2.51^{cd}
3	5.68^{c}	2.45^{b}	31.47^{c}	0.0182^{ab}	0.0083^{a}	3.17^{c}
4	9.21^{a}	5.45^{a}	57.78^{a}	0.0292^{a}	0.0099^{a}	4.65^{b}
5	8.21^{b}	5.31^{a}	46.88^{b}	0.0277^{a}	0.0124^{a}	6.76^{a}
6	4.12^{d}	1.41^{c}	27.82^{c}	0.0127^{ab}	0.008 ^{a}	1.67^{e}
CD (5%)	0.52	0.51	12.5	0.01	NS	1.4

There was significant difference between the treatments for the potassium uptake (kg ha^{-1}) in both the fields. In Pallikkandam, the average values for the K uptake showed the maximum value of 69.75 in the treatment T_4 and the minimum value of 5.22 in the treatment T_1. In Varyathpadi, the maximum value was 57.78 in the treatment T_4 and the minimum value of 3.71 in the treatment T_1.

There was significant difference between the treatments for the Ca uptake (kg ha^{-1}) in both the fields. In Pallikkandam, the Ca uptake among the different treatments showed the maximum value of 0.041 in the treatment T_4 and the minimum value of 0.004 in the treatment T_1. In Varyathpadi, the maximum value was 0.029 in the treatment T_4 and the minimum value of 0.003 in the treatment T_1.

In Pallikkandam, there was a significant difference between the treatments for the Mg uptake (kg ha^{-1}). The maximum value was observed in the treatment T_5 (0.022) and the minimum value in the treatment T1 (0.003). In Varyathpadi, there was no significant difference between the treatments for Mg uptake. The maximum was observed in the treatment T_5 (0.012) and the minimum in the treatment T_1 (0.002).

There was significant difference between the treatments for the silica uptake in both the fields. In Pallikkandam, the values for the Si uptake (kg ha^{-1}) among the different treatments showed the maximum of 9.83 in the treatment T_3 and the minimum of 1.65 in the treatment T_1. In Varyathpadi, the maximum was 6.76 in the treatment T_5 and the minimum was 1.01 in the treatment T_1.

4.8 Correlation studies

The simple correlation between yield contributing factors and fruit yield was worked out based on the data obtained for the different treatments.

4.8.1 Correlation between nutrient uptake and fruit yield

Simple correlation coefficients were worked out between nutrient uptake and the fruit yield of oriental pickling melon and are presented in the Tables 25 and 26.

Table 25. Correlation coefficient between nutrient uptake and fruit yield at Pallikandam

	Uptake of N	Uptake of P	Uptake of K	Uptake of Ca	Uptake of Mg	Uptake of Si
Uptake of N		.963**	**.977****	.967**	.783**	.814**
Uptake of P			.950**	.949**	.776**	.748**
Uptake of K				.972**	.764**	.822**
Uptake of Ca					.846**	.834**
Uptake of Mg						.560**
Uptake of Si						
Fruit yield	**934****	.900**	**.953****	.924**	.779**	.802**

** Correlation is significant at the 0.01 level (2-tailed).

Table 26. Correlation coefficient between nutrient uptake and fruit yield at Varyathpadi

	Uptake of N	Uptake of P	Uptake of K	Uptake of Ca	Uptake of Mg	Uptake of Si
Uptake of N		.932**	**.971****	.968**	.667**	.825**
Uptake of P			.887**	.938**	.593**	.790**
Uptake of K				.948**	.616**	.777**
Uptake of Ca					636**	.817**
Uptake of Mg						.688**
Uptake of Si						
Yield	**.944****	.861**	**.963****	.926**	.605**	.681**

** Correlation is significant at the 0.01 level (2-tailed).

In both the fields the N, P, K , Ca, Mg and Si uptakes were significantly and positively correlated with the fruit yield. In Pallikkandam, a highly significant positive correlation on fruit yield was observed with K uptake (r =.953**)** followed by N uptake (r= 0.934). In Varyathpadi, a highly significant positive correlation on yield was observed with K uptake (r =.963**)** followed by N uptake (r= 0.944).

4.8.2 Correlation between soil nutrients and fruit yield

The correlation of various soil nutrients in the flowering stage and harvest stage with the fruit yield were worked out. The results are presented in the Table 27. A positive and significant correlation was observed between yield and soil organic C in the flowering stage (r = 0.514) and with the available K content (r = 0.456) in the harvest stage. The fruit yield was negatively and significantly correlated with the available calcium content (r = -0.624) in the soil at the flowering stage of the crop.

4.8.3 Correlation between plant nutrients and fruit yield

The correlation of various plant nutrients on yield was worked out. The results are presented in the Table 28. The nutrients having a positive and significant correlation on yield were plant nitrogen (r = 0.709), phosphorus (r = 0.699) and potassium (r = 0.887). There was no significant correlation between total Ca, Mg and Fe and fruit yield. The highest positive significant correlations were observed between total K (r = 0.887) and total N (r = 0.709) on yield.

Table 27. Correlation coefficients of soil nutrients with yield

	Available nutrients at flowering stage						Available nutrients at harvest stage						
	Org.C	N	P	K	Ca	Fe	Organic C	N	P	K	Ca	Fe	Yield
Organic C		.118	.266	**.466***	-.421*	-.277	.295	.363	.055	.318	.060	-.264	**.514***
N			-.282	.335	.109	.122	.270	.298	-.101	-.214	-.001	-.049	-.045
P				-.099	-.313	-.114	-.105	.056	-.126	**.630****	-.181	.028	.356
K					-.188	.121	.101	.491*	-.248	-.280	.284	-.321	.224
Ca						-.099	-.429*	-.070	-.019	-.366	.091	-.085	**-.624****
Fe							-.011	.056	.127	-.365	-.248	-.132	-.015
Organic C								.050	.145	.262	.037	-.203	.397
N									-.004	-.009	-.198	-.338	-.024
P										-.148	-.020	-.276	.189
K											-.152	.018	**.456***
Ca												-.034	-.098
Fe													-.029

** Correlation is significant at 0.01 level (2-tailed).

* correlation is significant at 0.05 level

Table 28. Correlation Coefficients of plant nutrients with Yield

	N	P	K	Ca	Mg	Si	Yield
N		.595**	.782**	.459*	-.217	.084	**.709****
P			.567**	-.131	-.362	.080	.699**
K				.537**	-.424*	.257	**.887****
Ca					.140	-.048	.337
Mg						-.414*	-.331
Fe							.142

** Correlation is significant at 0.01 level (2-tailed).

* Correlation is significant at 0.05 level

Inter correlation among the different plant nutrients were also studied. The inter correlation of nutrients N, P, K and Ca were found to have a positive and significant. Among the nutrients, K was found to be positive significant correlation with N (r = 0.782). The other positive and significant correlations were between P and N (0.595), K and P (r= 0.567), Ca and K (0.537) and Ca and N (r = 0.459). Negative and significant correlation was observed between Mg and K (r = -0.424) and also between Si and Mg (r = -0.414).

4.8.4 Correlation between nutrient content of fruit and yield

The correlations of nutrient of fruit on yield were worked out. The results are presented in the Table 29. The nutrients having a positive and significant correlation on yield were calcium (r = 0.732), nitrogen (r = 0.640) and silica (r = 0.536). The contents of P, K, Mg and Fe did not show any significant correlatio

Table 29. Correlation coefficients of fruit nutrients with yield

	N	P	K	Ca	Mg	Fe	Vitamin A	Vitamin C	Crude fibre	Si	Yield
N		.519**	.101	**.673****	.272	.500*	.179	.474*	**-.720****	.516**	**.640****
P			.486*	.425*	-.054	**.542****	-.255	.115	-.439*	.491*	.201
K				.274	-.561**	-.131	-.353	.022	-.201	.527**	.278
Ca					.342	.168	.062	**.639****	-.561**	.479*	**.732****
Mg						.419*	.288	.139	-.049	-.065	.167
Fe							.041	.001	-.152	.153	.044
Vitamin A								-.097	.021	**-.582****	-.056
Vitamin C									**-.566****	.407*	.465*
Crude fibre										-.530**	-.550**
Si											.536**

** Correlation is significant at 0.01 level (2-tailed).

* Correlation is significant at 0.05 level

with the yield. Crude fibre showed a negative correlation (r = -0.550) with the yield.

The analysis showed that among the interactions between different nutrients twenty interactions were positive and significant. High positive and significant correlations were shown by N with Ca (r = 0.673), Ca with vitamin C (r = 0.639) and P with Fe (r = 0.542). High negative and significant correlations were observed for N with crude fibre (r = -0.720), vitamin A with Si (r = -0.582) and vitamin C with crude fibre (r = -0.566).

4.9 Path analysis

The direct and indirect contribution of different nutrients on yield can be found out by partitioning the correlation between yield and nutrient components into direct and indirect effects. Step wise regression was performed and the characters which showed significant correlation on yield were selected for path analyses. The characters were soil nutrient contents (available N, P, K, Ca and Fe) at flowering and harvest stages of the crop, plant nutrients of the vegetative parts at harvest (N, P, K, Ca, Mg, Si) and the nutrient content of fruit (N, P, K, Ca, Mg, Si, crude fibre, vitamin A and vitamin C).

4.9.1 Direct and indirect effects of soil nutrients on the fruit yield of oriental pickling melon

The data in Table 30 showed the direct and indirect effects of soil nutrients on the yield of crop. At both flowering (0.8561) and harvest stages (0.619), the available soil K exhibited a high positive and direct effect on yield. The available phosphorus in the harvest stage exhibited high and positive direct effect (0.5349) on yield.

Table 30. Direct and indirect effects of soil nutrients on yield of oriental pickling melon

Flowering stage						Harvest stage						Correlation with yield
Organic C	N	P	K	Ca	Fe	Organic C	N	P	K	Ca	Fe	
0.0499	0.0058	0.0132	0.0232	-0.0210	-0.0138	0.0147	0.0181	0.0027	0.0158	0.0030	-0.0131	0.5142**
-0.0009	-0.0083	0.0023	-0.0027	-0.0009	-0.0010	-0.002	-0.0024	0.0008	0.0017	5.53E-06	0.0004	-0.0453
0.0095	-0.0101	0.0360	-0.0035	-0.0112	-0.0041	-0.0037	0.0020	-0.0045	0.0226	-0.0065	0.0010	0.3556*
0.3987	0.2870	-0.0850	0.8561	-0.1611	0.1032	0.0868	0.4199	-0.2127	-0.2397	0.2428	-0.2745	0.2236*
0.0578	-0.0149	0.0430	0.0258	-0.1373	0.0135	0.0589	0.0095	0.0025	0.0502	-0.0125	0.0116	-0.6242**
-0.0081	0.0035	-0.0033	0.0035	-0.0029	0.0293	-0.0003	0.0016	0.0037	-0.0107	-0.0073	-0.0038	-0.01529
0.0249	0.0228	-0.0088	0.0085	-0.0362	-0.0009	0.0844	0.0042	0.0122	0.0221	0.0030	-0.0171	0.3965*
-0.1621	-0.1330	-0.0249	-0.2190	0.0311	-0.0251	-0.0223	-0.4466	0.0016	0.0040	0.0884	0.1508	-0.02431
0.0294	-0.0540	-0.0676	-0.1329	-0.0100	0.0679	0.0777	-0.002	0.5349	-0.0793	-0.0105	-0.1476	0.18857
0.1968	-0.1324	0.3902	-0.1734	-0.2268	-0.2260	0.1625	-0.0056	-0.0918	0.6195	-0.0940	0.0113	0.4560**
-0.0179	0.0001	0.0537	-0.0841	-0.0271	0.0736	-0.0108	0.0587	0.0058	0.0449	-0.2964	0.0101	-0.09835
-0.0639	-0.0118	0.0067	-0.0777	-0.02052	-0.0320	-0.0492	-0.0818	-0.0669	0.0044	-0.0083	0.2424	-0.02856

Direct effect of Ca (-0.2964) on yield was high and negative. The correation with yield is negatively significant.

Available soil K through N showed a moderate positive indirect effect (0.2431) on the yield at flowering stage and the correlation with yield was found positive. High positive indirect effect on yield was exhibited by available K through organic C in the flowering stage (0.3987) and its correlation with yield was positive. Available K through Fe showed a moderate negative indirect effect (-0.2745) on yield at harvest stage and its correlation with yield was positive.

4.9.2 Direct and indirect effects of nutrients of vegetative plant parts on the yield of oriental pickling melon

The data on Table 31 showed the direct and indirect effects of nutrients of vegetative plant parts on the fruit yield. High positive and direct effect on yield was exhibited by the plant K content (0.9705) and its correlation with yield was also positive. A moderate and positive direct effect was exhibited by P content on yield (0.2514) and correlation with the yield was found positive. The plant Ca content showed low (-0.1233) negative direct effect on the yield followed by the N content on yield (-0.1076), but they were in positive correlation with the yield.

High positive indirect effects were exhibited by plant K through N (0.7589), plant K through P (0.5502) and K through Ca (0.5206). Its correlation with yield was also found positive (0.8872). High negative indirect effect on the yield was exhibited by K through Mg (-0.4111) and its correlation with yield was positive (0.8872).

Table 31. Direct and indirect effects of plant nutrients on yield of oriental pickling melon

	N	P	K	Ca	Mg	Si	Correlation with yield
N	-0.1076	-0.0640	-0.0841	-0.0493	0.0233	-0.009	0.7087**
P	0.1495	0.2514	0.1425	-0.0329	-0.0910	0.0202	0.6986**
K	0.7589	0.5502	0.9705	0.5206	-0.4111	0.2490	0.8872**
Ca	-0.0566	0.0161	-0.0661	-0.1233	-0.0171	0.0058	0.3374**
Mg	-0.0298	-0.0498	-0.0583	0.0193	0.1376	-0.0569	-0.3309**
Si	-0.0055	-0.0053	-0.0171	0.0031	0.0276	-0.0668	0.1423

Residual: 0.1362

Table 32. Direct and indirect effects of fruit nutrients on yield of oriental pickling melon

	N	P	K	Ca	Mg	Fe	Vitamin A	Vitamin C	Crude fibre	Si	Correlation with yield
N	5.1536	2.6723	0.5183	3.4670	1.3992	2.5774	0.9214	2.4410	-3.7083	2.6606	0.8872**
P	0.7288	1.4055	0.6836	0.5977	-0.0764	0.7612	-0.3577	0.1616	-0.6175	0.6895	0.3374**
K	0.1653	0.7998	1.6444	0.4502	-0.9222	-0.2152	-0.5810	0.0357	-0.3311	0.8661	-0.3309**
Ca	-3.9675	-2.5081	-1.6149	-5.8977	-2.0163	-0.9912	-0.3633	-3.7696	3.3088	-2.8230	0.1423
Mg	1.0230	0.2048	-2.1126	1.2882	0.7680	1.5802	1.0860	0.5249	-0.1847	0.2454	0.6397**
Fe	-4.1156	-4.4570	-1.0773	-1.3830	-3.4511	-0.2292	0.3347	0.0069	1.2487	-1.2570	0.2009*
Vitamin A	0.1645	0.2342	0.3251	0.0567	0.2652	0.0374	-0.9202	0.0894	-0.0196	0.5358	0.2778*
Vitamin C	-2.5942	-0.6298	-0.1191	-3.5008	-0.7631	-0.0046	0.5324	-5.4771	3.1009	-2.2280	0.7317**
Crude fibre	2.9910	1.8263	0.8369	2.3321	0.2038	0.6307	-0.0886	2.3534	-4.1565	2.2045	0.1674
Si	-2.3919	-2.2729	-2.4404	-2.2183	-0.3017	-0.7077	-2.6981	-1.8847	2.4572	-0.6332	0.0435

Residual: .00005

4.9.3 Direct and indirect effects of nutrients of fruits on yield of oriental pickling melon

The data in Table 32 showed the direct and indirect effects of nutrients of fruit on the fruit yield. A very high positive and direct effect on yield was exhibited by the fruit N content on yield (5.1536). Fruit P content (1.55) and K content (1.6444) also showed very high positive and direct effect on the yield. The plant Ca showed a very high (-5.8977) negative direct effect on the yield followed by vitamin C (-5.4771) and crude fibre (-4.1560).

4.10 Yield prediction

In soil test crop response correlation studies, yield is computed as a function of soil and fertilizer nutrients keeping all other factors at optimum level. In the present study the relationship of yield with soil nutrient content at the flowering stage was found out. Similarly the relationship of yield with biometric observations at the flowering stage was also found out.The relationships were used for making predicting yield. The statistical method used for the yield prediction based on the above parameters was non linear procedure using SAS system. The mode of iteration used was Gauss- Newton.

4.10.1 Yield prediction equation based on the biometric observations at the flowering stage

In this model three variables were taken into consideration viz., length of vine in meters (x_1), internodal distance in meters (x_2) and number of leaves (x_3). The prediction equation is as follows

$$\textbf{Yield (Y)} = 1669.3^{*} e^{0.0469 x_1 + 0.0978 x_2 + 0.00925 x_3}$$

Where, Y = Yield (kg ha^{-1})

$R^2 = 47.73\%$.

4.10.2 Yield prediction equation based on the soil nutrients at the flowering stage

In this yield prediction six variables were taken into consideration viz., organic C in per cent (x_1), available N in kg ha^{-1} (x_2), available P in kg ha^{-1} (x_3), available K in kg ha^{-1}(x_4), available Ca in kg ha^{-1} (x_5) and available Fe in kg ha^{-1} (x_6)

$$\textbf{Yield (Y)} = 7211.8 * e^{1.1287\ x_1 + 0.000365\ x_2 + 0.0285\ x_3 - 0.0012\ x_4 - 0.0236\ x_5 - 0.00033\ x_6}$$

Where, Y = Yield (kg ha^{-1})

R^2 = 67.68%.

Among these prediction equations, higher variability was explained for yield prediction based on nutrient status of the soil. Hence prediction based on soil parameters will be more accurate.

4.11 Economics of cultivation

The economic analysis (Benefit : cost analysis) of the different treatments are given in the Table 33. The analysis reveals the superiority of the treatment T_4 followed by treatment T_5. Although the total cost of cultivation was high in these treatments, the net profit and B : C ratio were higher. Among the treatments the treatment T_4 gave higher benefit cost ratio.

Thus the present investigation threw light into the variations in the crop production depending upon the various treatments adopted. It also considered the various types of the nutrient interactions in soil, plant and fruit components with respect to the yield of the crop. Yield prediction equations were also worked out depending on the various field observations.

Table 33. Economic analysi

	Pallikandam				Varyathpadi			
Treatments	Total cultivation cost/ha (Rs)	Total benefit /ha (Rs)	Actual profit/ ha (Rs)	B/C ratio	Total cultivation cost/ha (Rs)	Total benefit /ha (Rs)	Actual profit/ ha (Rs)	B/C ratio
1	41533.2	9235	-32298.18	-	41533.2	6844	-34689.18	-
2	71614	100500	28886.01	1.40	71614	75120	3506.01	1.05
3	71270.2	83805	12534.84	1.18	71195.5	75787.5	4592.05	1.06
4	72947.8	159330	86382.20	2.18	71795	135120	63325.03	1.88
5	75513.2	123075	47561.80	1.63	73356.2	96900	23543.79	1.32
6	106100	116167.5	10067.50	1.09	106100	94590	-11510.00	0.89

Discussion

5. DISCUSSION

Oriental pickling melon is an important cucurbitaceous vegetable grown in many parts of Kerala. The prime objective of an intensive agricultural system is to achieve the highest yield per unit area. The crop production has to be increased through the efficient and economic use of fertilizers. Fertilizer application is one of the most efficient means of increasing the profitability. The quantity of fertilizers to be applied to a crop largely depends upon the inherent fertility of soil. Soil test based fertilizer recommendation has become much more relevant in the present scenario of high fertilizer cost and yield maximization programmes.

The soil test based fertilizer prescription equation developed for the oriental pickling melon in the laterite soils of Kerala has to be test verified for the wider acceptability of the technique in the normal field conditions. The yield predictability of the equation has to be verified over the other treatments which are followed by farmers.

The effects of the nutrients especially, organic carbon, nitrogen, phosphorus, potassium, calcium, magnesium and iron in the soil and plant on the yield were carried out in the present investigation in the laterite soils of Kerala using the crop oriental pickling melon.The study also focused on the effects of treatments on quality parameters of the crop

5.1 Field verification trials on oriental pickling melon using STCR technology

5.1 1 Effect of treatments on yield parameters.

Crop production being a complex process has been influenced by large number of exogenous and endogenous factors. In this experiment the yield of oriental

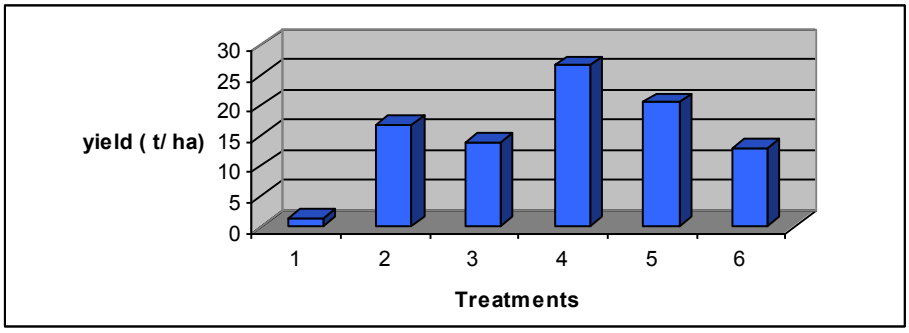


Fig. 3. Effect of treatment on fruit yield in Pallikandam

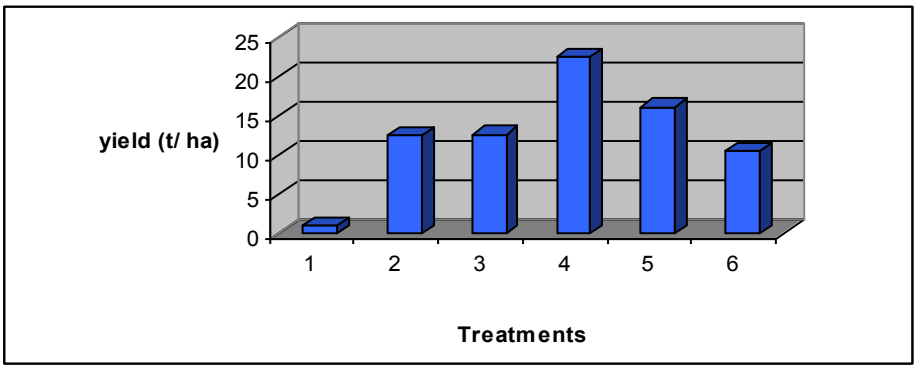


Fig.4. Effect of treatment on fruit yield in Varyathpadi

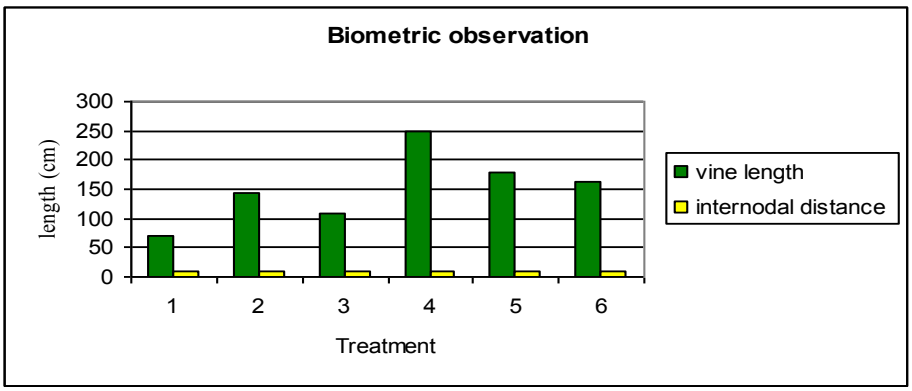


Fig. 5. Effect of treatment on growth characters in Pallikandam field

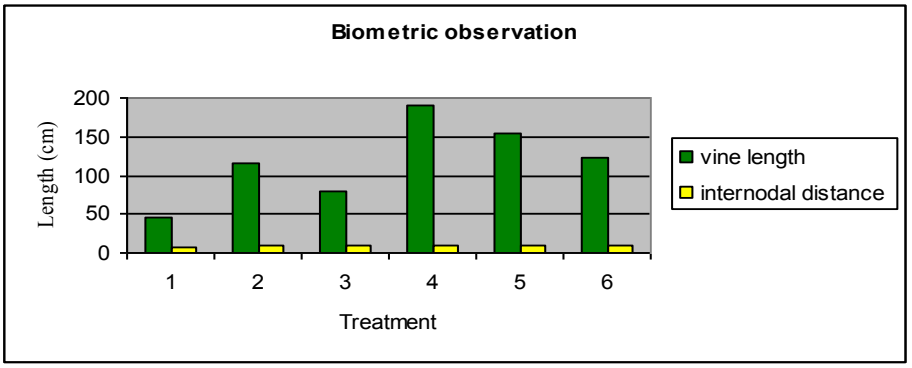


Fig. 6. Effect of treatment on growth characters in Varyathpadi field

pickling melon was recorded separately for each treatment. The yield and various yield parameters are furnished in the Tables 13 and 14. The yield difference is exhibited in the Figures 3 and 4. It showed the differential response of nutrients to yield in different fertility levels.

The fruit yield obtained from the treatment T_4 (STCR 1) was the highest among the treatments. The reason may be the nutrients supplied in this treatment were sufficient and balanced. The lowest yield was for the treatment T_1 (FP). It indicated that this crop require N and K fertilizers in sufficient quantity. From these observations it is evident that the nutrients, N and K are the most essential elements for obtaining good yield in oriental pickling melon.

The highest doses of fertilizer applied in the treatment T_5 (STCR 2) gave lesser yield compared to the treatment T4. From this it can be inferred that the quantities of fertilizer applied in the treatment T_5 was excess for the plant and the law of diminishing returns might have operated here.

Considering the yield parameters like length and girth of fruit, there were significant increase in these characters in the treatments T_4 and T_5 and the fruits obtained were fleshier. It may be due to the high amounts of N fertilizer applied in these treatments. It was also observed that in these treatments the uptake on N, P and K were also high. In the treatment T_1, the fruits were small and not attractive because the uptake of nutrients was the minimum in this treatment.

In the case of vegetative growth characters like length of vine, internodal distance and the number of leaves the maximum values were observed in the treatment T_4 followed by T_5 and the lowest values in the treatment T_1. These observations indicate that N, P and K should be applied in correct quantity and

correct proportion. The treatment differences for these characters are shown in the Figures 5 and 6.

5.1.2 Soil properties

The basic soil physico chemical properties like pH, EC, CEC, organic carbon, N, P, K, Ca, and Fe were analysed. The soils were also analysed at flowering and harvest stages of the crop for the same parameters. At the harvest stage, the organic C content slightly increased from the flowering stage compared to the initial stage of soil. This may be due to the application of farm yard manure in all the treatments. Nitrogen content decreased in all the treatments and it is relatively higher in the treatment T_4. This shows a high absorption of this nutrient by the growing plant. The available P showed a decrease in the flowering stage and from this it can be inferred that P requirement in the seedling stage is high. As P is slowly released, the released P might have been taken by the seedlings. In the case of available K, there was a decrease in its content in the soil at harvest stage due to the heavy uptake of this nutrient by oriental pickling melon. Available P increased in the harvest stage due to the slow release of P from the applied and native sources. These trends showed the differential uptake of these three major plant nutrients and consequent influence on the crop yield. The content of Fe and Ca showed only a slight decrease from the initial to harvest stage of the crop, because of the uptake of these nutrients by the plants may be less.

5.1.3 Plant nutrients

Plant samples were analysed for nutrients like N, P, K, Ca, Mg and crude silica content. The Figures 7 and 8 depict plant N, P and K contents in the various treatments. The plant nutrient contents of N, P and K were high in the treatment T_4 where the highest yield was observed. Among these nutrients the percentage concentration of K was the highest followed by N and P. The lowest content of N, P

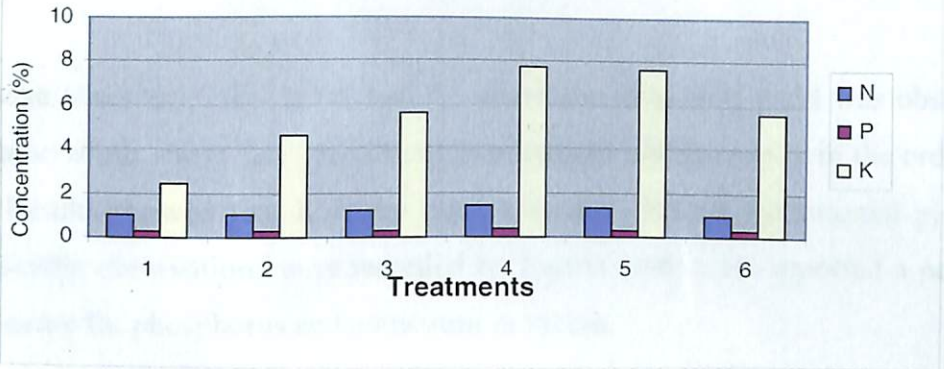


Fig. 7. Variation in N, P and K content in the vegetative parts of the crop at Pallikandam

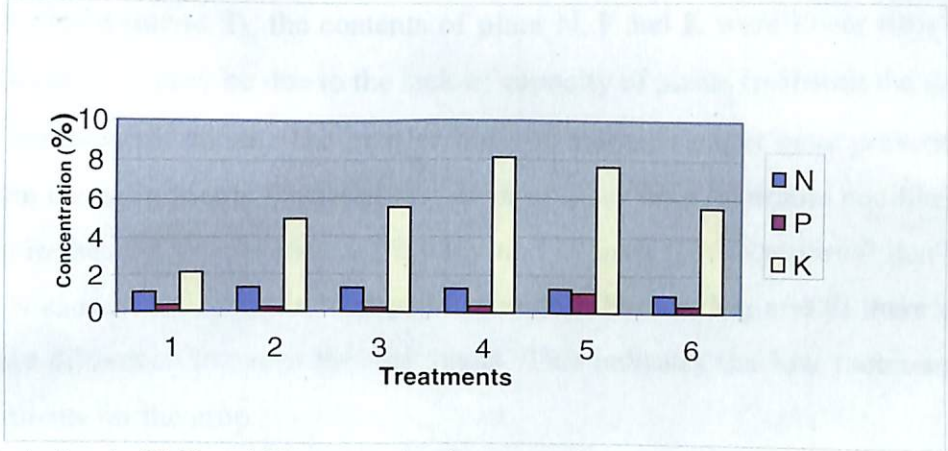


Fig. 8. Variation in N, P and K content in the vegetative parts of the crop at Varyathpadi

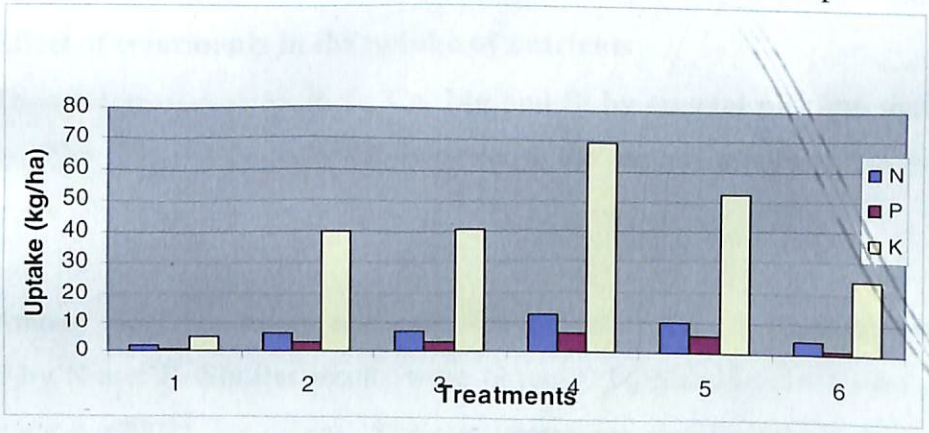


Fig. 9. Variation in uptake of N, P, and K content at Pallikandam

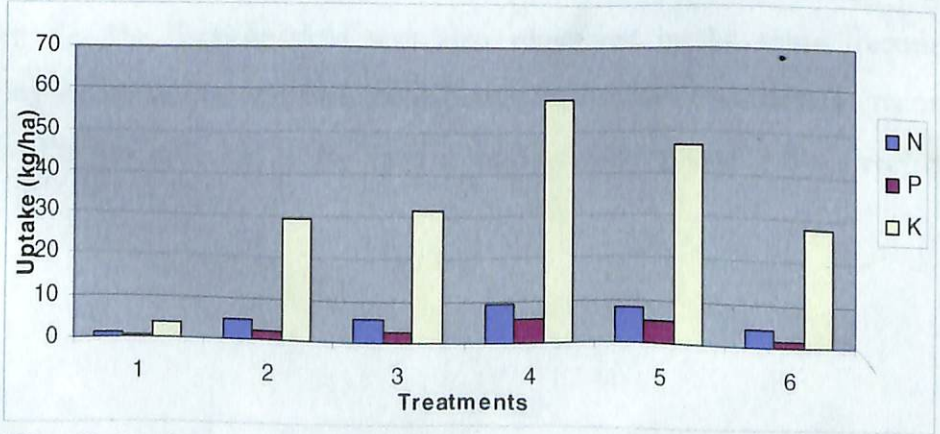


Fig. 10. Variation in uptake of N, P, and K content at Varyathpadi

and K were observed in the treatment T_1, where the minimum yield was observed. These observations show that the nutrient requirement of this crop is in the order K> N > P. Results showed that K is the most essential element for oriental pickling melon. Similar observations were recorded by Sutton (1965). He reported a positive yield response for phosphorus and potassium in melon.

In the treatment T_5, the contents of plant N, P and K were lower than that in the treatment T_4. It may be due to the lack of capacity of plants to absorb the quantity of fertilizer nutrients added. The heavier dose of nutrients might have prevented the plant from taking nutrients from soil and there may not be a favorable equilibrium of nutrients in the soil for the plants. Brantley and Warren (1961) reported that higher rates of N cause a reduction in total yield in melon. For Ca, Mg and Si there was no significant difference between the treatments. This indicates the low requirement of these nutrients for the crop.

5.1.4 Effect of treatments in the uptake of nutrients

The total uptake of N, P, K, Ca, Mg and Si by oriental pickling melon was calculated separately. The uptake of nutrients in the various treatments is shown in the Figures 9 and 10.

Among the three major nutrients, the highest uptake was registered by K followed by N and P. Similar results were obtained by Swadija (1997) for cassava and Nagarajan (2003) for coleus. Various treatments significantly influenced the uptake of nutrients. The maximum uptake for N, P, and K was observed in the treatment T_4. The highest yield was also registered in the same treatment. On comparing the uptake of nutrients for different treatments, treatment T_1 recorded the lowest and it was reflected in the yield also. The result revealed the direct effect of

fertilizer application on the uptake of nutrients and consequent influence on the yield of oriental pickling melon.

5.2 Quality aspects

The nutrient contents of fruits for the various treatments are depicted in the Figures 11 and 12.

Highest values for N, P and K contents in fruits were observed in the treatments T_4 and T_5 and the lowest values of P and K in the treatment T_6. The lowest values of N were noticed in the treatments T_2 and T_1. In the case of Ca, Mg and Fe there was no significant variation among the treatments. Content of Si was highest in the treatment T_5.

Marschner *et al.,* (1999) reported that in cucumber, Si could act as a beneficial element under conditions of nutrient imbalance. Cucumber has got a cosmetic value because of its Si content. The commercial value of the fruit can be improved by high dose of fertilizer application.

Vitamin C content of the fruit was found higher in the treatments T_4 and T_5. This observation is supported by the reports of Krynska *et al.* (1976). In cucumber Vitamin C content rose with increasing nitrogen, phosphorus and potassium. Crude fibre content was high in the treatments, T_2 and T_1. This may be due to the lowest nitrogen content in these treatments. The lowest crude fibre content was observed in the treatments T_4. It may be due to the high nitrogen content. The N and crude fibre contents showed a reverse trend. Figures 13 and 14 show the variation in crude fibre content between the treatments.

Rotting percentage of fruit was high in the treatments T_4 and T_5. This may be due to the high N content and low crude fibre content in the fruits. The lowest rotting

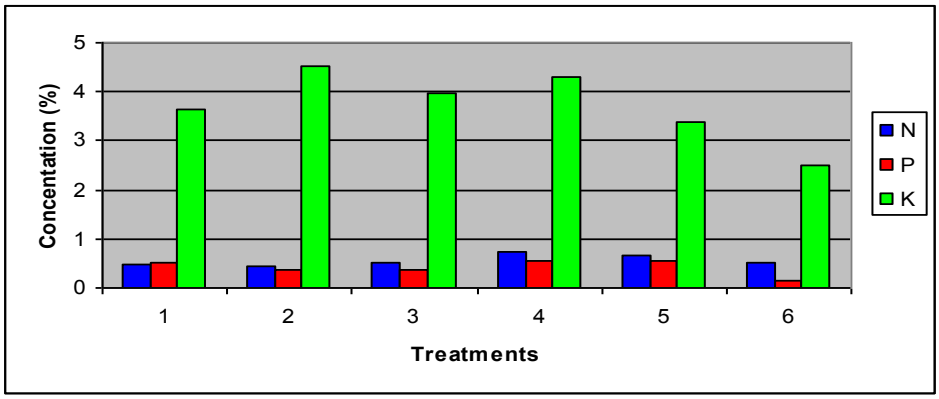


Fig. 11. N, P and K content in the fruits of oriental pickling melon at Pallikandam

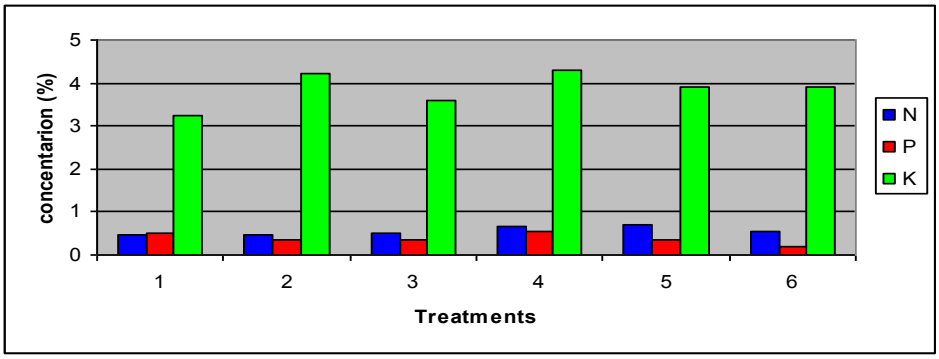


Fig. 12. N, P and K content in the fruits of oriental pickling melon at Varyathpadi

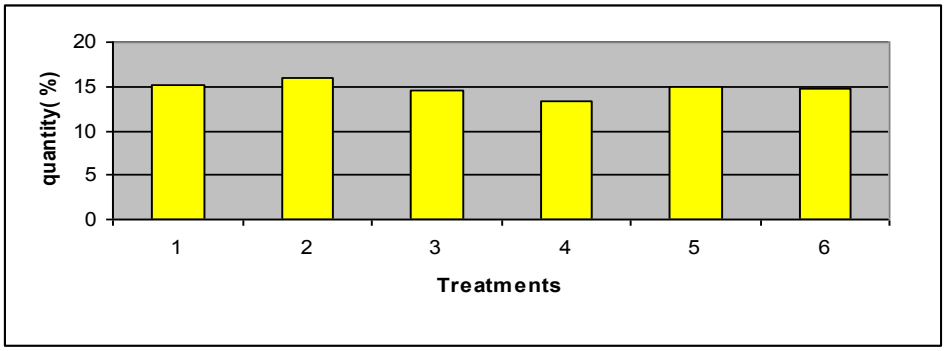


Fig. 13. Crude fibre content in the fruits at Pallikkandam

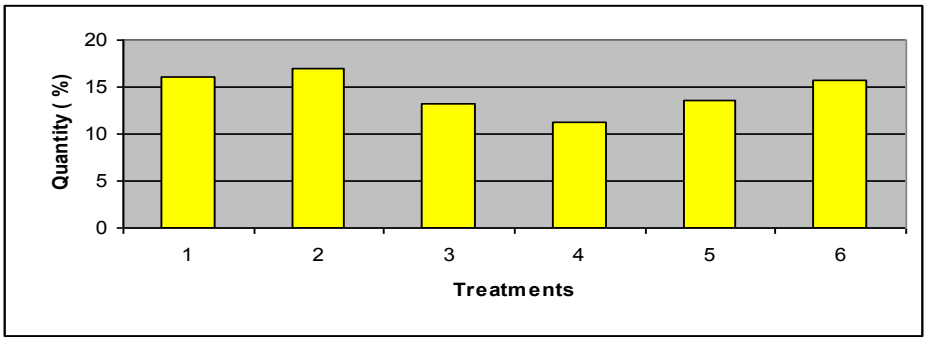


Fig. 14. Crude fibre content in the fruits at Varyathpadi

percentage in melon or higher keeping quality was observed in the treatment T_2. From this it can be inferred that the crude fibre content increases the keeping quality of the fruit. It was supported by the observations of Joseph (1985) that highest rotting percentage was observed with fruits under the treatment which received the highest doses of N, P and K completely in the inorganic forms in melon.

5.3 Yield prediction

The yield of the crop can be predicted utilizing the soil nutrient contents and taking the biometric observations in the flowering stage of the crop.

5.4 Correlation studies

Yield is a complex character contributed by many mutually related factors. A positive significant correlation indicates that respective nutrient component has a certain relationship with yield suggesting their importance in determining fruit yield. A high and positive inter correlation show that when there is an increase in one nutrient the other nutrient also increases.

Simple correlation coefficients were worked out for nutrient uptake, available nutrients in the soil, plant nutrients and fruit nutrients with the yield of oriental pickling melon. The uptake of N, P, K, Ca, Mg and Si were positively correlated with yield because of the direct influence on the uptake. Among this K was highly positively correlated followed by N, Ca and P. The nutrients N and K are very important for the accumulation of carbohydrate and protein content of the fruit and there by increasing the size of the fruit. The inter correlation between the nutrients were also significant. Similar results were obtained by Meena (1999) and Nagarajan (2003).

Correlation between soil nutrients in the flowering and harvest stage of the crop with the yield was found significant. Soil organic carbon in the flowering stage was positively correlated with yield. Similarly available K in the harvest stage was also found positively correlated with the yield. This is due to the high requirement of the above nutrients for the crop. Correlation between plant nutrients and yield showed a higher positive correlation of yield with plant K followed by N and P. From this it may be inferred that the order of requirement of these primary nutrients are K > N > P. Nitrogen is of prime importance in plant compared to P in getting better yield.

Correlation studies between the fruit nutrients and yield indicates that fruit N has a high and positive correlation with the yield. It indicates that N plays an important role in increasing the fruit yield. Ca content in the fruit also shows positive correlation with the yield. It may be due to the beneficial effect of Ca in the N uptake by the fruit.

5.4 Path analysis

5.4.1 Path analysis of soil nutrients with yield

This analysis was conducted with yield and soil available N, P, K, Ca and Fe. Soil K exhibited the highest positive direct effect on yield followed by P. These results indicated higher available K in soil directly influenced the yield. This result also again proved that the contribution of K in the plant for the yield obtained. Higher values of correlation coefficients support this result.

5.4.2 Path analysis of plant nutrients with yield

Path analysis was carried out with crop yield and plant nutrients namely N, P, K, Ca, Mg and Si. Plant K exhibited the highest positive direct effect on the yield

followed by plant P. The result indicated that the higher K content in plant resulted in higher fruit yield. The higher values of correlation also support the above finding.

A low negative direct effect was manifested by plant Ca and N. Even though these characters show a direct negative effect, they show a positive correlation with the yield. It indicates that over doses of Ca and N can result in a decreasing yield. But they have got indirect effects through other nutrients, which causes the increase in yield.

5.4.3 Path analysis of fruit nutrients with yield

Path analyses were carried out with crop yield and the fruit nutrients. The highest direct positive effect on yield was exhibited by N. This observation is supported by the high positive correlation of plant N with the yield. It means that as the N content in the fruit increases, the yield also increases.

The result indicated the higher concentration of K in the plant reflected higher crop yield. These findings were also supported by their higher correlation coefficient with the yield.

From these results it is concluded that the fertilizer applied as per the equations is contributing much of the crop requirements for good yield. However future works have to be done in several other locations before the recommendation of this equation for large scale adoption.

Summary

6. SUMMARY

The emphasis on soil test based fertilization has become much more relevant in the present scenario of high fertilizer cost and yield maximization programme. The targeted yield equations developed in the research centres have to be test verified in the cultivators' field prior to their wide scale adoption by the farming community.

The present investigation was carried out to test verify the targeted yield equations developed for oriental pickling melon by the STCR centre, Vellanikkara, Kerala Agricultural University. For this study, two fields one in Pallikkandam and another in Varyathpadi were selected in Pattikkad area of Thrissur district. The fields were separated by a distance of 1.5 km. The field verification trials were for two yield targets viz, 30t/ha and 45 t/ha. The experiment was conducted during the period September – January 2009.

The other objectives of this investigation include the nutrient interactions study and the quality evaluation of oriental pickling melon. The field experiments consisted of six treatments and four replications each. The treatments were, Farmer's practice (T_1), Recommendations of KAU (T_2), Soil testing laboratory recommendations of Kerala (T_3), STCR recommendations for yield target of 30 t ha^{-1} (T_4), STCR recommendations for yield target of 45 t ha^{-1}(T_5) and application of organics alone (T_6). The targeted yield equations used for verification trial were as follows

$FN = 3.24\ T - 0.095\ SN$

$FP_2O_5 = 1.64\ T - 1.332\ SP$

$FK_2O = 3.16\ T - 0.068\ SK$

The basic soil fertility status was analysed and based on the values, fertilizers were applied. Soil fertility status during the flowering and harvest stages were analysed for various physico - chemical parameters like pH, EC, CEC, organic carbon, available N, P, K, Ca and Fe to study the nutrient interactions. Plant samples and fruit samples in each treatment were also analysed for the nutrients like N, P, K, Ca, Mg Fe, vitamin A, C, crude fibre and Si after the harvest. The treatment wise biometric observations for vegetative characters and yield characters were also recorded. Simple correlation coefficients were worked out for nutrient uptake, soil nutrients, plant nutrients and fruit nutrients with the yield. The effects of nutrients on yield were determined using correlation studies and path analysis studies. The results of the experiment are summarized as follows.

- The fruit yield showed the maximum in the treatment T_4 in both the fields and the yield was 26.56 and 22.52 t ha^{-1} in field 1 and 2 respectively. The minimum yield was recorded in treatment T_1 in both the fields and the yield was 1.37 and 0.97 t ha^{-1} in field 1 and 2 respectively.

- The vegetative growth characters (length of vine, internodal distance and number of leaves) were also superior in the treatment T_4. Fruit characters (length and girth of fruit) were also found superior in treatment T_4 followed by T_5.

- The uptake of N, P and K was the maximum in the treatment T_4 followed by T_5. The average uptake of nutrients in T_4 were recorded as 12.09, 6.45 and 69.75 $kgha^{-1}$ and 9.21, 5.45 and 57.78 $kgha^{-1}$ of N, P and K in field 1 and 2 respectively. The minimum uptake was observed in the treatment T_1, which represented the farmers practice.

- The uptake of K was the maximum followed by N and P. In plant, N, P and K content was higher in T_4 followed by T_5. The lowest value for plant N, P and K content was recorded in the treatment T_1.

- The uptake of N, P, K, Ca, Mg and Si was highly and significantly correlated with the yield. Among the nutrients, K was highly correlated with yield followed by N and P.

- In soil, available K in the harvest stage was correlated with the yield.

- The N, P and K content of fruit was the maximum in the treatments T_4 and T_5. Si content was also found high in the treatments T_4 and T_5.

- Among the vitamins, vitamin C was maximum in the treatments T_4 and T_5.

- The maximum crude fibre content of the fruit was observed the in the treatment T_2 and T_1 and the minimum in T_4.

- Rotting percentage of fruits was maximum in the treatments T_4 and T_5 and minimum in the treatment T_2.

The study concluded that the targeted yield equation developed at STCR centre, Vellanikkara, for oriental pickling melon is found successful to an extent. This equation has to be further subjected to 4-8 test verification trials and 3-4 field demonstration trials to ensure the performance of the equation. Then only we can state that the equation is good for recommendation among farmers.

References

References

Ahmed, R.S., Reddy, K.C. and Khedka, K.M. 2000. Soil test based optimal fertilizer requirement for attaining different yield targets of castor (*Recimum Communis*) in dryland alfisol. *Indian J. agric. Sci*. 71: 24-27

Alphonse, M. and Saad, E.M. 2000. Growing green house cucumber in FYM and chicken manure media in combination with foliar application of Zn, Mn and B. *Egpn J. Hort.* 27(30) : 315-336

Al Sahaf, F. M. and Al Khafagi, B.H.S.1990. Influence of N,P, K concentration on growth and yield of cucumber (*Cucumis sativus*) in sand culture. *Ann. Agri. Sci.* 35(1): 383-391

Anderson, R.L. and Nelson, L.A.1975. A family of involving interesting straight lines and concomitant experimental design useful in evaluating response to fertilizer nutrients. *Biometrics*.31: 303-318

Anisimov, A.A. 1953. The effect of nitrogen fertilizers on vitamin C content. *Sad i ogorod.* 6: 41-43

Bage, J., Ghanti, P., Mandal, A.R. and Paria N.C. 2000. Effect of organic manures on growth and yield of pumpkin (*Cucurbita moschata*). *Res. Crop*. 1(1): 74-78

Biswas and Mukharjee. 1990. *Text book of soil science*.Tata McGraw – Hill publication Ltd. NewDelhi.

Bradley, G.A., Fleming, J. W. and Mayes, R.L. 1961. Yield and quality of pickling

melon and cantaloupes as affected by fertilization. *Bull. Ark. Agric. Exp. Stn*. 23 : 643

Brantley, B.B. and Warren, G.F.1960. Effect of nitrogen on flowering, fruiting and quality of water melons. Proc. *Am.Soc. Hort.Sci.* 75: 645-649

Bray, R. H. 1948. *Diagnostic Techniques for Soils and Crops*. The American Potash Institute, Washington. p.53

Bray, R.H. and Kurtz, C.T. 1945. Determining total, organic and available form of phosphate in soil. *Soil Sci.* 59: 39-45

Bolotskish, A.S. 1969. The effectiveness of minerals on growing cucumbers under irrigated conditions. *Himija Sel. Hoz*. 7: 19-20

Buzzetti, S. and Hernandez, F.B.T. 1993. Nitrogen and Potassium fertilization in musk melon culture (*Cucumis melo.* L.). *Actas del congreso Latinoamericano de laciencie del Sneto*, Salamones, Brazil. pp.516-574

Cantliffe, D. J. 1977. Nitrogen fertilizer requirements of pickling cucumbers grown for once over harvest. *J. Am. Soc. Hort. Sci*. 102: 115-119

Cate, R.B. and Nelson, L.A. 1965. *A Rapid Method Of Correlation Of Soil Test Analysis With Plant Response Data.* North Carolina State University, Releigh. p.48

Cate, R.B. and Nelson, L.A. 1971. A simple statistical procedure for partitioning soil test correlation data into two classes. *Proc. Soil Sci. Am.* 35: 656- 658

Chand, M., Vig, A.C. and Dev, G. 1986. An estimate of fertilizer dasage on soil test basis for the targeted yield of green gram (*Vigna rediata.* L.). *Legume Res*. 9: 16-20

Chand, M., Vig, A. C., Dev, G. and Sindhu, A.S. 1984. Evaluation of fertilizer recommendation based on soil tests for targeting rice yield on cultivator's field. *J. Res. Punjab Agric. Univ.* 21: 20-28

Cheng, K. L. and Bray, .H. 1957. Determination of calcium, magnesium in soil and plant material. *Soil Sci.* 72:42

Chopra, S.L. and Kanwar, J.S. 1978. *Analytical Agricultural Chemistry*. Kalyani publishers, Ludhiana. 110 p.

Demiral, M.A. and Koseoglu, A.T. 2005. Effect of potassium on yield, fruit quality and chemical composition of greenhouse-grown Galia melon. *J. Plant Nutrition.* 28 (1) : 93-100

Dev, G.M., Brar, J.S. and Dhillon, N.S. 1978. Fertilizer requirement for different yield targets of paddy based soil test values in tropical acid brown soils. *Fertil. News.* 23: 35- 37

Dev, G.M., Brar, J. S.,Dhillon, N.S. and Vig, A.C. 1985. Soil test based yield targets for wheat production. *Fertil. News*. 30 : 50-52

Dhesi, N. S., Padda, D.S. and Malik, B.S. 1964. Effect of N, P and K on the yield of squash melon. *Panjab Hort. J.* 4: 45-47

Dhesi, N. S., Padda, D. S. and Malik, B. S. 1966. Response of bittergourd to N, P and K fertilization. *Indian J. Hort.* 23: 169-171

Dhillon, N.S., Sindhu, A.S. and Dev, G.1978. Targetting of wheat yield based soil test values. *Fert. Tech.* 15: 57-58

Dominy, A. and Bertling, I. 2004. Manganese, zinc and silicon studies of cucumber (*Cucumis sativus*) using a miniature hydroponic system. *Acta Horticulturae.* (644) : 393-398

Duraisamy, P., Raniperumal and Baskaran, S. 1989. Fertilizer tailoring with organics for the needed yield target. *Fert. News.* 34 : 33-39

Eggert, E. P. 1961. *Factors Affecting Fruit Condition*. New Jersey Agr. Exp. Station, Rutgers. The State University, New Brunswick. 234 p

Everett, P.H. 1963. Minor elements and nitrogen studies with cucumber. *Proc. Fla. St. Hort. Soc*. 76 : 143-149

FIB [Farm Information Bureau]. 2007. *Farm guide*. Govt. of Kerala.

Ferrante,A., Spinardi, A., Maggiore, T. and Testoni, A. 2008. Effect of nitrogen fertilisation levels on melon fruit quality at the harvest time and during storage. *J. Sci.Food and Agriculture.* 88 : 707-713

Fischer, D.V and Parrith, S.W. 1951. *Apple harvesting and storage in British Columbia*. Canadian Department of Agricultural Publications. 724 p

Freed, R. 2006. MSTAT–C version 7. Department of Crop and Soil Science. Michigen State University.

Gananakumari, B. and Satyanarayana, G. 1971. Effect of N, P and K fertilizers at different rates on flowering, yield and composition of brinjal. *Indian J. Agric. Sci.* 41: 554-558

Gul, A. Kdoglu, F. and Anac, D. 2007. Determination of fertilization in culture of the muskmelon (*Cucumis melo L.*). *Scientia Horticulturae*.113 (2) : 216-220

Gupta, Y.P. and Das, N.B. 1954. The quality of wheat as affected by manures and fertilizers. *J. Indian Soc. Soil Sci*. 2 : 121-125

Goswamy, N.N., Bapat, S.R. and Pathak, V.N. 1986. Studies on relationship between soil tests and crop responses to phosphorus under field conditions. *International Symposium on Soil Fertility Evaluation, March 4-8, 1986*. NewDelhi. p.356.

Guo, X., Ye, S., Wang, W., Zhu, B. and Wu, L. 2004. Effect of different K sources and rates on the yield and quality of cucumber. *Plant Nutr. Fert. Sci.* 10 (3): 292-297

Gupta, Y.P. and Das, N.B. 1954. The quality of wheat as affected by manures and fertilizers. *J. Indian. Soc. Soil Sci.* 2 (2) : 121-125

Hadid, A., Mohamed, A. and Ibrahim, A. 2001. Effect of composted greenhouse wastes on macro-nutrients concentration and productivity of cucumber. *Acta-Horticulturae*. 549 : 123-130

Handershot, W. H. and Duquette, M. 1986. A simplified Barium Chloride method for determining CEC and exchangeable cation. *Soil Sci. Am.J.* 50 : 605-608

Hassan, M.A., Sasidar, V.K. and Peter, K.V. 1984. Effect of graded doses of nitrogen, phosphorus, potassium on growth and yield of oriental pickling melon (*Cucumis melo.* V. conomon). *Agric. Res. J. Kerala*. 22 (1) p.43-47

Haworth, F., Cleaver, T.J. and Bray, J.M, 1966. The effects of different manurial treatments on the yield and mineral compositions of early potatoes. *J. Hort. Sci.* 41: 225-241

IISS.1999. Annual Report 1993-1998. *All India coordinated Research Project for Investigations on Soil Test Crop Response correlation*, Indian Institute of Soil Science, Bhopal. p.87

IISS.2007. Prescription based fertilizer recommendations-A key to successful fertilizer application in Kerala. *All India coordinated Research Project for Investigations on Soil Test Crop Response correlation*. Kerala Agricultural University, Thrissur, Kerala. p.73

Jackson, M.L. 1958. *Soil Chemical Analysis.* Prentice Hall of India Private Ltd. NewDelhi. 498 p.

Jaksungnaro. and Akali, S. 2001. Effect of sowing time and nitrogen level on growth, yield and quality of cucumber. *Haryana J.Hort.Sci.* 30 (1/2) : 108-110

Jayalakshmi, M. 2001. Soil test crop response studies on ginger in laterite soils of Kerala. MSc.(Ag) thesis, KAU, Trichur. p.110

Jha, S.V.K., Suri, V.K. and Verma, T.S. 1997. Response of rainfed maize to integrated nutrient management based on targeted yield concept in a Typic Hapludalf. *J. Indian. Soc. Soil. Sci.* 45 : 603-607

Joseph, L. 1985. Quality and storage life of oriental pickling melon (*Cucumis melo* V. conomon) as influenced by major nutrients. M Sc. (Ag.) thesis, Kerala Agricultural University, Vellanikkara, Thrissur. p.66

KAU [Kerala Agricultural University].1989. NARP status report- southern zone, Vol. 1, Directorate of Extension, Kerala Agricultural University, Mannuthy, Trichur. p. 86

KAU [Kerala Agricultural University]. 2008. *Package of Practices Recommendation : Crops* (12thed). Directorate of Extension, Kerala Agricultural University, Mannuthy, Trichur. p. 334

KAU [Kerala Agricultural University]. 2008. Annual Report 2008-2009. *All India coordinated Research Project for Investigations on Soil Test Crop Response correlation*. Kerala Agricultural University, Mannuthy, Trichur.

Kanwar. 1971. Soil fertility evaluation for balanced fertilization. *Fer. News*.

28 : 23- 34

Kim. H. T., Kang, K.V., Choung, H.D. 1991. The process of salt accumulation and its effects on the field and quality of musk melon (*Cucumis melo)* on successively cultivated soil. *Report of Rural Development Administration.* 33(3) : 7- 15

Krynska, W., Kawecki, Z. and Piotrowski, L. 1976. The effect of fertilization, irrigation and cultivar on the quality of fresh, sour and pickled cucumbers. *Zeszyty Naukowe Akademy Rolnicso Techniczhei W olsetynic, Rolnictwo.* 15 : 109-123

Largskii, Y.N. 1971. The effects of fertilizers on changes in mobile forms of soil nutrients and cucumber quality. *Agrokhimiya.* 2 : 138-141

Largskii, Y.N. 1969. The effect of fertilizers on vegetable quality. *Agrokhimiya.* 2 : 77-79

Lester, G.E. and Jifon, J.L. 2007. Foliar applied potassium : effects on cantaloupe quality. *Acta Horticulturae* (731) : 115-119

Lingle, J.C. and Wight, J.R. 1960. The yield, fruit quality and leaf analysis of cantaloupes as affected by N and P fertilizers. *Vegetable Crops Survey.* University of California. p.110

Liu,Y., Yu, X. and Jiang, J. 2006. Effects of nitrogen fertilization on the quality of self-rooted and grafted cucumber. *Plant Nutr. Fert. Sci.* 12 (5) : 706-710

Liu, M. and Chen, D. 1996. Effects of nitrogen amount on yield and nitrate accumulation of cucumber. *China Vegetables*. (3) : 26-28

Loganathan, S., Kelkiah, J. and Thanga Velu. 1995. Fertilizer application to groundnut based on soil test crop response equations. *Madras Agric. J.* 82 : 195-198

Maene, L. 2001. Global potassium fertilizers situation : Current use and perspectives. In: Paricha, N.S. and Bansal, S.K.(eds.), *Proceedings Of International Symposium On Importance Of Potassium In Nutrient Management For Sustainable Crop Production in India,* December 6-8, 2001, NewDelhi, India. pp 226-238

Marschner, H., Oberle, H., Cakmak, I. and Romheld, V.1999. Growth enhancement by silicon in cucumber (*Cucumis sativus*) plants depends on imbalance in phosphorus and zinc supply. *Plant and Soil*. 124 (2) : 211-219

Mathan, K. K., Samboornaraman, S. and Wolpera, K. 1974. Efficiency of inorganics and organics to potato. *Madras Agr. J*. 61(5) : 97-101

Marti, H. R and Mills, H .A. 2002. Nitrogen and potassium nutrition affect yield, dry weight partitioning, and nutrient-use efficiency of sweet potato. *Comm.in Soil Sci. and Plant Anal.* 33 (1/2) : 287-301

Meena, S. 1999. Soil test crop response correlation studies on onion (A*llium cepa*) in ultisol. MSc (Ag.) thesis, ANGRAU, Rajendra Nagar, Hyderabad. p.96

Mitscherlich, E. A. 1909. Das Gestez des abnehmanden Bodenertrages. *Landw. Jb.* 38: 537-552

Nambiar, E. P., Jacob, C. I. and Nair, T.J. 1977. Digital expression of soil fertility –A new approach to the interpretation of soil test data and formulation of fertilizer recommendations. *Agri. Res. J.Kerala*. 16 : 201-209.

Nagarajan, M. 2003. Soil test crop response studies on coleus (*Solenostemon rotundifolius*) in the laterite soils of Kerala. MSc (Ag.) thesis. Kerala Aricultural University, Thrissur, Kerala. p.88

Nath, P. 1976. *Vegetables for the Tropical Region-First Edn*. Indian Council of agricultural Research, New Delhi. p.32

Navarro, J.M., Botella, M.A. and Martinez,V.1999. Yield and fruit quality of melon plants grown under saline conditions in relation to phosphate and calcium nutrition. *J. Hort. Sci. Biotech*. 74 (5) : 573-578

Nilson, T. 1979. Yield, Storage ability, quality and chemical composition of carrot, cabbage and leek at conventional and organic fertilizing. *Acta. Hort*. 93 : 209-223

Omoroi, S., Sugimoto, M. and Ogura, I. 1972. Studies on the utilisation of large quantities of animal manures for horticultural crops. *Bulletin Kanagava Hort. Exp. Stn*. 20 : 58- 66

Panagiotopoulos, L .2001. Effects of nitrogen fertigation on growth, yield, quality and leaf nutrient composition of melon (*Cucumis melo* L.). *Acta Horticulturae*. 563 : 115-121

Park, H. and Chiang, M. 1997. Effect of form and concentration of nitrogen in aeroponic solution on growth, chlorophyll, nitrogen contents and enzyme activities in *cucumis sativus*. *J. Korean Soc. Hort. Sci.* 38 : 642- 646

Parker, F.W., Nelson, N.L., Winters, E. and Miles, I.E. 1951. The broad interpretation and application of soil test information. *Agron. J.* 28 : 105- 112

Peterson, L.E. 1958. How much nitrogen for melon?. *Am. Veg. Grow*. 6 : 3-33

Patil, S.D., Keskar, B.G. and Lawande, K.E.1998. Effect of major nutrients on sex expression in cucumber (*Cucumis sativus L.*). *S. Indian Hort.* 46 (1/2) : 18- 21

Perkin, E. C. 1974. *Analytical methods for Atomic Absorption Specroscopy*. Norwalk, USA

Pew, W.D. and Gardner, B.R. 1972. Nitrogen effects on cantaloupes. *Comm. Soil Sci. Pl. Ana.* 3: 467-476

Piper, C.S. 1966. *Soil and Plant Analysis*. Hans publication, Bombay. p.225

Ragimova, A.M. 1987. The effect of micro fertilizers on yield, quality and nitrate nitrogen accumulation in cucurbitaceous fruits. *Iromn Retervatovmegi zhireal*. 62: 189-190

Ramamoorthy, B., Narasimhan, R.K. and Dinesh, R.S. 1969. Fertilizer application for specific yield targets of Sonora 64 (wheat). *Indian Fmg*. 17 : 43-45

Ramamoorthy, B. and Velayutham, M. 1974. Recent trends in marking fertilizer recommendations based on soil test under fertilizer response constraints in India. *FAI seminar on optimizing agricultural production under limited availability of fertilizer.* Nov. 4-7, 1974. NewDelhi. FAI. p.335-346

Ramamoorthy, B. 1974. Project co coordination report. Vl workshop of soil test crop response correlation project, Jabalpur. p.158

Ramamoorthy, B. 1993. Soil fertility and fertilizer use aspects for increasing rice production. Tamil Nadu agricultural University, Coimbatore.p.54

Ramamoorthy, B and Pathak, V.N. 1969. Soil fertility evaluation - key to targeted yields. *Indian Fmg*. 18 : 29-33

Randhawa, K.S. and Bhail, A.S. 1976. Growth, yield and quality of cauliflower as influenced by nitrogen, phosphorus and boron. *Indian J. Hort.* 33: 83-90

Randhawa, K.S. and Singh, K. 1970. Influence of foliar applications of certain chemicals on sex behaviour, fruit set and quality of musk melon. *Pl. Sci.* 2: 118-122

Randhava, N. S. and Velayutham, M. 1971. *Soil Test Crop Response Correlation Work in India – World Soil Resource Report No. 41*, FAO, Rome. p.105

Randhava, N.S. and Velayutham, M. 1974. Soil testing for high fertilizer use efficiency. *Indian Fmg*. 24 : 80-84

Randhava,N.S. and Velayutham,M. 1982. Research and development programme for soil testing in India. *Fert. News*. 27: 35-64.

Raniperumal, S., Chandrasekharan, A., Natarajan, K., Mani, S. and Ramanathan, P. 1982. Soil test crop response studies in the State of Tamil Nadu. Tamil Nadu Agricultural University, Coimbatore. p.78

Rani Perumal, S., Chandrasekharan, A., Natarajan, K., Mani,S.and Ramanathan,P. 1984. Soil test crop response studies in the state of Tamil Nadu- Bulletin. Dept. of Soil Science and Agricultural Chemistry, TNAU, Coimabatore. p.89

Raniperumal, S., Chandrasekharan, A., Natarajan, K., Mani, S. and Ramanathan, P. 1987. Rationalised fertilizer prescription for rice- Alfisol alluvium based on soil test crop response studies. *Madras agric. J.* 74 : 312-319.

Raniperumal, S., Chandrasekharan, A., Natarajan, K., Mani, S. and Ramanathan, P. 1988. Soil test crop response studies in the State of Tamil Nadu. Tamil Nadu Agricultural University, Coimbatore. p.78

Raniperumal, S. and Velayudham, M. 1982. Research and development programme for soil testing in India. *Fertil. News.* 27 : 35-64

Rastogi, K.B. and Arya, D.A.1990. Note on inter-relationship between yield and important plant characters of cucumber (*Cucumis sativus L.*). *Vegetable Sci.* 17 (1) : 102-104

Reddy, K.C.K., Singh, K.D. and Velayutham, M. 1987. Balanced fertilization of rice based on soil testing. *Symposium on nutrient management in rice based cropping system,* Sep 28- Oct 1, 1987. ICAR, New Delhi. p.315-328.

Reddy, K.C.K., Sanker, G.R.M. and Velayudham, M. 1985. All India Coordinated Research Project for Investigations on Soil Test Crop Response Correlation- Instruction Manual. CRIDA, ICAR, Hyderabad. p.168.

Reddy, K.C.K and Ahmed, R.S. 1999. Soil test based fertilizer recommendation for groundnut grown in rice fallows (Inceptisols) of jugtail in Andra Pradesh. *J. Oilseeds. Res.* 16 : 257-262

Rikorski, I. and Djordjevic, V. 1952. The effect of storage on the ascorbic acid content of vegetables. *Arb. Poljopr. Nauk.* 5 : 72-82

Rodriguez, Z. and Pire, R. 2004. Extraction of N, P, K, Ca and Mg by cantaloupe plants (*Cucumis melo* L.) packstar hybrid under Tarabana conditions. *Revista de la Facultad de Agronomia*. 21 (2) : 141-154

Sadasivam, S. and Manickam, A. 1996. *Biochemical Methods.* Tamil Nadu Agricultural University, Coimbatore. New Age International (p) Ltd.

Salas, M. C., Urrestarazu, M., Bretones, A. and Sanchez, R. 2005. Melon crop response to different levels of calcium in the nutrient solution. : *Acta-Horticulturae.* 697 : 487-492

Sanker, G. R. M., Reddy, K. C. K, Sonar, K. R. and Daftardar, S. Y. 1989. Multi colinearity in soil test crop response data. *J. Maharashtra Agric. Univ*. 16: 259-260

Sanker. G. R. M.1986. On screening of regression models for the collection of optimal variable subsets. *J. Indian Soc. Ag. Statistics*. 38 : 161-168

Santhi, R. 1995. Soil test crop response studies under integrated plant nutrition system for rice-rice –pulse sequence. PhD thesis, TNAU, Coimbatore. p.176.

Santhi R., Natesan, R. and Selvakumari, G. 2002. Soil test crop response correlation studies under integrated plant nutrition system for onion in inceptisols of Tamil Nadu. *J. Indian Soc. Soil Sci.* 50.: 489-492

Schramer, S. and Werner, W. 1957. The effect of nutrition upon the ascorbic acid content of plants. *Z. Pfiernahr. Dung*. 77 : 97-110

Sidha, P.S. 2005. Soil test crop response studies on groundnut in the laterite soils of Kerala. MSc (Ag.) thesis. Kerala Aricultural University, Thrissur, Kerala. p.83

Singh , K.D. and Sharma, B.M. 1994. Soil test based fertilizer recommendations for economic yield of wheat and maize. *Indian J. Agric. Res*. 24: 225- 229

Sims, J.T. and Johnson, G.V. 1991. Micronutrient soil tests in agriculture (2nd edn). SSSA Madison, USA, p.427-472

Singh, K.D. and Sharma, B.M. 1978. Fertilizer recommendation based on soil tests for targeted yields of different crops. *Fert. News*. 23 : 38-42

Singh, R., Singh, M. and Dixit, M. L. 2000. Soil test based balanced fertilizer recommendation for cotton and wheat crops. *Haryana Fmg*. 30 : 14-16

Sirohi, P.S. 1997. Improvement in cucurbitaceous vegetables. *Indian Hort.* 42 : 2

Song, S., Le, J., Lehne, P., Ge, T. and Huang, D.2008. Comparative study of fruit quality of muskmelon in organic and conventional farming systems. *J. Shanghai Jiaotong Uni.Agri.* Sci. 26 (3) : 212-217

Soltani, F., Kashi, A. and Babalar, M. 2007. Effect of nitrogen form on yield, fruit number and leaf nutrient content of two green house cucumber cultivars in soilless culture. *Acta Horticulturae*. (731) : 273-276

Subbiah , B.V. and Asija , G. L. 1956. A rapid procedure for estimation of available nitrogen in soil. *Curr. Sci*. 25 : 259-303

Subbiah, K. and Ramanathan, K. M. 1982. Influence of N and K_2O on the crude protein, carotene, ascorbic acid and chlorophyll content of amaranthus. *South Indian Hort*. 30 : 80-95

Sutton, P. 1965. Effect of nitrogen, phosphorus and potassium on squash yield. *Proc. Soil. Sci. Soc.* 25 : 46-50

Swadija, K.O, Sobhana, S. and Padmaja, P. 1993. Fertilizer recommendation based on soil tests for targeted yield. In : Nair, R.C.(ed.), *Proceedings of the fifth Kerala Science Congress;* January 5-10,1993, Kottayam. p.182-184

Swadija, K.O.1997. Soil test crop response studies on cassava on laterite soils of Kerala. Ph D thesis, Kerala Agricultural University, Vellanikkara, Trichur. p.146

Tandon, H.L.S. 1994. Fertilizers and their integration with organics and biofertilizers. Fertilizers, organic manures, recyclable wastes and biofertilizer components of integrated plant nutrition, FDCO, New Delhi. pp. 12-35

Thomas, J. R. Mac.Lean, D.M. 1967. Growth and mineral composition of squash (*C. pepo*) as affected by nitrogen, phosphorus, potassium and tobacco ring spot virus. *Agron. J.* 59 : 67-69

Thomas, J. R. 1966. The effect of nitrogen and phosphorus on the concentration of various plant nutrients in squash (*C. pepo*). *Proceedings of 17th International Horticulture Congress.* 1: 459

Umamaheswarappa, P., Gowda, V.N., Murthy, P.V. and Krishnappa, K.S. 2005. Growth, yield and quality of cucumber (*Cucumis sativus* L.) as influenced by varying levels of nitrogen, phosphorus and potassium. *Karnataka J.Hort.* 1 (4) : 71-77

Tuncay, O.I., Gul, A. and Budak, N. 1999. Relationships between fruit quality characteristics and leaf nutrient contents of cucumber plants. In: Anac, D . and

Martin, P. (ed.), *Improved crop quality by nutrient management.* Ege University, Faculty of Agriculture, Turkey. p.195

Velayutham, M. 1979. Fertilizer recommendation based on targeted yield concept, problem and prospects. *Fert. News*. 24 : 12-20

Velayutham, M. and Reddy, K.C.K. 1990. Nutrient management based on soil test crop response correlation research. In: Singh, K.D. (ed.), *Soil fertility and fertilizer use*, IFFCO, New Delhi. p.135

Verma, T.S., Suri, V.K. and Paul, J. 2002. Prescription based fertilizer recommendations for rice, wheat and maize for different agro climatic zones of Himachal Predesh. *J. Indian Soc. Soil Sci.* 50 : 272-277

Yalcn, S.R. and Topcuoglu, B. 1994. Effect of phosphorus fertilization on yield and some plant nutrients in cucumber. *Ankara-Universitesi-Ziraat-Fakultesi-Yllg*. 44 (1/2) : 201-205

Yoshida, S., Forno, D.A., Cock, J.H. and Gomez, K.A. 1972. *Laboratory Manual for Physiological Studies for Rice.* International Rice Research Institute, Los Bonos, Philippines.

Watanabe, F.S and Olsen, S.R. 1985. Test of an ascorbic acid method for determining P in water and sodium carbonate extracts from soil. *Proc. Soil Sci.Am.* 29 : 39-45

Walkley, A.J and Black, I.A. 1934. Estimation of soil organic C by chromic acid titration method. *Soil sci.* 31-29-38.

Wilcox, E.B and Morrel, K.E. 1948. The vitamin contents of peas as influenced by maturity, fertilizers and variety. *Bull. Utah. Agric. Exp. Stn.* 337 : 16

Appendices

Appendix I **Nutrient status of soil at flowering stage of crop in Pallikkandam**

Treatments	Replication	pH	EC	CEC	OrganicC%	Available nutrients (Kg/ha)				
						N	P	K	Ca	Fe
1	1	5.1	0.04	3.8	1.201	501.76	23.92	416.60	72.35	94.75
1	2	5.1	0.04	3.7	1.200	627.20	20.45	338.80	80.64	101.25
1	3	5.4	0.05	4.1	1.060	423.36	19.74	325.60	85.12	82.43
1	4	4.6	0.03	4.0	1.350	627.20	20.02	396.00	70.78	90.94
2	1	5.1	0.06	4.0	1.323	627.20	20.60	649.60	76.38	98.34
2	2	5.4	0.05	4.0	1.260	689.90	18.90	604.80	56.00	99.68
2	3	5.2	0.06	3.8	1.360	689.92	15.92	604.80	49.28	108.64
2	4	4.8	0.05	4.1	1.320	564.48	17.90	660.00	78.40	90.05
3	1	5.0	0.02	4.5	1.286	689.92	16.30	716.80	67.42	117.15
3	2	5.1	0.03	4.4	1.296	712.81	18.42	680.00	78.85	137.20
3	3	5.1	0.02	4.8	1.302	721.27	16.82	672.00	69.89	87.14
3	4	5.1	0.01	4.9	1.202	689.90	19.20	638.40	56.00	116.93
4	1	5.2	0.08	4.2	1.314	627.20	22.17	386.60	63.17	107.97
4	2	4.8	0.06	4.5	1.348	627.20	20.90	638.40	53.20	100.80
4	3	5.2	0.06	4.2	1.402	627.20	26.52	386.00	52.40	86.91
4	4	4.7	0.07	4.4	1.398	501.76	25.96	301.60	46.80	82.19
5	1	4.7	0.05	4.2	1.460	376.32	17.80	707.20	50.10	79.52
5	2	5.2	0.05	4.1	1.492	627.20	25.82	884.80	55.60	108.64
5	3	5.4	0.04	3.9	1.389	564.48	24.25	986.00	51.97	116.48
5	4	5.0	0.06	4.0	1.450	627.20	23.80	836.90	62.50	72.22
6	1	5.8	0.03	4.6	1.412	878.80	18.30	806.40	71.99	72.61
6	2	5.6	0.02	4.1	1.412	689.94	22.60	806.40	67.76	81.94
6	3	5.5	0.04	4.2	1.024	627.20	20.82	586.00	59.49	116.17
6	4	4.9	0.03	3.6	1.321	564.48	21.80	629.80	57.34	138.88

Appendix II **Nutrient status of soil at flowering stage in Varyathpadi**

Treatments	Replication	pH	EC	CEC	OrganicC%	Available nutrients (Kg/ha)				
						N	P	K	Ca	Fe
1	1	4.9	0.04	4.0	1.201	476.30	23.14	131.80	85.34	116.70
1	2	4.8	0.05	4.3	1.402	463.80	18.94	125.40	80.86	131.26
1	3	4.9	0.03	4.5	1.100	425.30	20.20	123.20	57.12	146.50
1	4	5.1	0.03	4.0	1.300	480.26	20.20	171.60	53.54	108.64
2	1	4.5	0.02	4.3	1.450	589.56	21.52	240.80	73.47	87.58
2	2	4.7	0.03	4.6	1.360	584.82	26.55	237.40	59.14	116.93
2	3	4.6	0.02	4.5	1.270	502.20	22.40	224.40	56.45	81.20
2	4	4.4	0.05	4.8	0.990	452.60	22.40	940.80	48.16	64.74
3	1	4.4	0.04	4.4	0.890	456.30	20.53	268.00	66.75	81.76
3	2	4.5	0.05	4.5	1.300	352.30	24.31	672.00	43.68	84.90
3	3	4.8	0.05	4.6	1.260	298.60	20.30	288.20	36.74	145.60
3	4	4.3	0.04	4.3	1.120	357.50	23.82	292.60	63.17	80.42
4	1	4.7	0.06	4.2	1.200	564.48	20.53	388.00	71.90	118.50
4	2	4.6	0.06	4.4	1.350	588.60	25.54	312.40	77.95	145.60
4	3	4.7	0.05	4.2	1.140	501.76	25.80	154.00	54.21	117.15
4	4	4.4	0.05	4.3	1.250	540.80	26.80	160.80	58.46	132.16
5	1	4.6	0.04	4.0	1.456	671.10	23.14	915.00	44.35	102.30
5	2	4.7	0.05	3.6	1.123	662.80	26.71	974.40	36.96	138.43
5	3	4.7	0.04	3.9	1.165	388.86	27.32	851.20	27.10	133.95
5	4	4.6	0.05	4.2	1.456	674.10	25.80	848.00	78.85	123.65
6	1	5.0	0.02	4.7	1.360	560.20	24.69	652.30	74.37	111.55
6	2	4.8	0.03	4.9	0.968	580.60	22.67	425.60	82.66	89.15
6	3	5.2	0.05	3.9	1.478	371.32	22.27	638.00	57.79	125.44
6	4	4.9	0.04	5.1	0.895	420.90	21.90	523.60	44.35	108.86

Appendix III **Nutrient status of soil at harvest stage of crop in Pallikkandam**

Treatments	Replication	pH	EC	CEC	OrganicC%	Available nutrients (Kg/ha)				
						N	P	K	Ca	Fe
1	1	5.1	0.04	4.0	1.180	203.83	24.68	266.56	56.00	116.70
1	2	5.0	0.03	4.5	1.152	218.85	24.65	258.20	59.14	138.88
1	3	5.2	0.04	4.6	1.256	212.10	25.60	286.30	56.22	82.43
1	4	4.9	0.05	4.2	1.980	268.90	21.20	284.50	59.36	125.44
2	1	5.2	0.03	3.9	2.014	219.12	24.30	250.88	47.26	108.86
2	2	4.6	0.04	4.5	2.265	214.30	25.45	249.65	57.34	105.06
2	3	4.8	0.02	4.6	2.435	254.60	25.10	255.80	50.62	101.70
2	4	5.0	0.02	4.8	1.250	236.20	21.20	264.30	56.45	145.60
3	1	4.1	0.02	4.9	1.860	225.79	26.30	221.76	66.75	89.15
3	2	4.9	0.05	5.1	1.596	257.89	28.60	230.50	53.76	93.18
3	3	4.5	0.09	3.5	1.369	256.98	24.90	221.80	54.10	111.55
3	4	4.2	0.06	3.4	1.240	215.50	26.90	228.20	67.65	138.66
4	1	4.6	0.02	2.9	2.140	222.68	32.50	380.80	59.36	89.15
4	2	4.6	0.03	5.1	2.814	215.30	25.50	321.68	53.76	111.55
4	3	4.7	0.03	3.8	1.547	265.20	24.60	368.80	29.12	120.06
4	4	4.9	0.06	3.5	1.960	195.20	24.60	412.50	56.00	144.48
5	1	4.8	0.05	4.2	1.580	219.55	25.80	291.20	64.96	117.60
5	2	5.0	0.03	4.6	1.360	254.20	24.50	258.40	50.62	104.16
5	3	4.8	0.01	4.8	1.840	354.60	24.60	304.50	56.00	81.98
5	4	4.5	0.05	4.8	1.950	214.20	20.60	298.87	91.84	107.52
6	1	4.9	0.06	4.7	2.010	269.80	20.60	313.60	58.24	116.48
6	2	5.1	0.03	4.9	1.514	254.20	11.20	358.80	60.03	86.46
6	3	5.0	0.02	5.0	1.654	214.30	12.30	286.50	53.76	165.76
6	4	5.8	0.05	3.8	1.547	201.30	16.80	295.60	46.82	102.59

Appendix IV **Nutrient status of soil at harvest stage of crop in Varyathpadi**

Treatments	Replication	pH	EC	CEC	OrganicC%	Available nutrients (Kg/ha)				
						N	P	K	Ca	Fe
1	1	5.1	0.03	3.8	1.823	238.80	23.46	250.80	57.34	116.70
1	2	5.3	0.02	3.5	1.694	298.60	25.84	268.24	52.64	131.26
1	3	4.7	0.03	4.5	2.350	254.30	26.30	256.24	57.12	146.50
1	4	5.2	0.05	4.6	1.580	265.50	25.30	235.60	53.54	108.64
2	1	4.9	0.06	4.0	1.961	220.36	22.65	251.20	73.47	87.58
2	2	4.2	0.06	4.6	2.350	225.36	22.56	254.40	59.14	116.93
2	3	4.6	0.03	4.9	1.650	235.50	26.50	265.30	56.45	81.20
2	4	5.0	0.01	3.8	1.360	265.40	24.60	234.50	48.16	89.15
3	1	5.2	0.02	5.0	2.102	220.36	24.52	242.50	66.75	81.76
3	2	4.3	0.04	3.5	2.120	265.65	26.50	265.50	43.68	104.16
3	3	4.2	0.03	3.6	1.960	224.60	29.80	234.60	36.74	101.47
3	4	4.9	0.03	3.8	1.860	223.80	28.70	223.50	63.17	147.39
4	1	4.8	0.06	4.8	1.814	226.50	26.87	324.80	71.90	118.50
4	2	4.7	0.08	4.9	1.694	263.50	27.80	354.80	36.96	145.60
4	3	4.5	0.06	4.7	1.965	289.70	28.70	286.50	54.21	130.82
4	4	4.2	0.03	4.6	1.819	312.20	25.40	295.50	29.12	132.16
5	1	4.6	0.05	4.6	1.916	242.60	24.01	296.70	44.35	109.54
5	2	5.2	0.02	3.5	2.014	258.60	25.69	305.20	36.96	138.43
5	3	5.3	0.02	3.6	2.063	297.60	26.98	369.80	27.10	133.95
5	4	4.6	0.03	3.5	1.756	245.30	24.60	356.40	53.76	123.65
6	1	4.7	0.04	3.9	1.513	201.80	24.50	289.10	48.38	111.55
6	2	4.9	0.05	4.0	1.654	196.30	19.65	265.40	59.36	89.15
6	3	5.3	0.03	4.6	1.743	235.50	20.36	302.20	53.98	125.44
6	4	5.8	0.04	4.8	1.425	168.40	21.60	275.60	36.74	143.36

AppendixV **Nutrient status of plant in Pallikkandam**

Treatments	Replication	N %	P%	K%	Ca %	Mg %	Si %
1	1	1.00	0.300	2.50	0.0025	0.0018	1.25
1	2	1.10	0.280	2.40	0.0024	0.0019	0.96
1	3	0.90	0.310	2.60	0.0026	0.0018	1.50
1	4	1.00	0.320	2.30	0.0023	0.0017	1.00
2	1	1.02	0.314	4.90	0.0026	0.0019	0.62
2	2	1.10	0.324	4.80	0.0026	0.0019	0.80
2	3	1.00	0.324	4.20	0.0027	0.0020	0.60
2	4	1.05	0.330	4.60	0.0028	0.0021	0.75
3	1	1.26	0.301	5.72	0.0035	0.0020	0.67
3	2	1.30	0.300	5.78	0.0038	0.0020	0.67
3	3	1.26	0.304	5.60	0.0036	0.0025	1.06
3	4	1.10	0.302	5.40	0.0033	0.0022	0.81
4	1	1.42	0.348	7.86	0.0028	0.0014	0.70
4	2	1.45	0.350	7.90	0.0025	0.0014	1.86
4	3	1.40	0.351	7.58	0.0029	0.0015	1.50
4	4	1.46	0.347	7.60	0.0029	0.0019	1.40
5	1	1.31	0.321	7.70	0.0032	0.0012	2.06
5	2	1.35	0.321	7.60	0.0034	0.0015	0.50
5	3	1.34	0.320	7.80	0.0035	0.0016	1.50
5	4	1.28	0.318	7.50	0.0039	0.0015	1.40
6	1	1.00	0.314	5.80	0.0028	0.0016	1.00
6	2	1.00	0.314	5.50	0.0027	0.0016	0.94
6	3	0.90	0.289	5.60	0.0029	0.0019	2.10
6	4	0.95	0.301	5.40	0.0028	0.0012	1.40

Appendix VI **Nutrient status of plant in Varyathpadi**

Treatments	Replication	N %	P%	K%	Ca %	Mg %	Si %
1	1	1.01	0.304	2.00	0.0026	0.0018	0.86
1	2	1.00	0.305	2.15	0.0025	0.0019	0.80
1	3	1.05	0.300	2.60	0.0028	0.0018	0.94
1	4	1.02	0.309	1.89	0.0025	0.0019	0.85
2	1	1.20	0.300	5.00	0.0025	0.0014	0.52
2	2	1.24	0.300	4.90	0.0024	0.0015	0.71
2	3	1.25	0.290	4.50	0.0023	0.0014	0.68
2	4	1.35	0.280	5.20	0.0023	0.0013	0.61
3	1	1.20	0.294	5.52	0.0024	0.0010	0.67
3	2	1.26	0.298	5.56	0.0024	0.0010	0.42
3	3	1.30	0.301	5.42	0.0025	0.0010	0.38
3	4	1.31	0.301	5.60	0.0023	0.0010	0.40
4	1	1.34	0.364	8.10	0.0028	0.0002	0.70
4	2	1.36	0.358	7.90	0.0028	0.0003	0.60
4	3	1.35	0.391	8.50	0.0026	0.0002	0.40
4	4	1.28	0.354	7.60	0.0029	0.0003	0.40
5	1	1.28	0.144	8.50	0.0035	0.0015	1.80
5	2	1.30	1.430	7.80	0.0036	0.0016	0.80
5	3	1.29	1.560	7.50	0.0034	0.0014	0.96
5	4	1.50	1.320	6.90	0.0035	0.0016	0.91
6	1	1.00	0.325	5.60	0.0016	0.0016	0.70
6	2	0.96	0.365	5.40	0.0016	0.0017	0.68
6	3	0.98	0.289	5.50	0.0018	0.0015	0.61
6	4	0.89	0.224	5.80	0.0019	0.0016	0.81

Appendix VII Nutrient status of fruit in Pallikkandam

Treatments	Replication	N %	P%	K%	Ca %	Mg %	Fe %	Vit.A %	Vit.C %	Crude fibre %	Si %
1	1	0.49	0.508	3.70	0.0024	0.0010	0.0008	0.0004	0.0140	16	0.34
1	2	0.54	0.498	3.50	0.0024	0.0010	0.0007	0.0004	0.0160	16	0.32
1	3	0.45	0.518	3.60	0.0023	0.0012	0.0009	0.0003	0.0130	17	0.20
1	4	0.39	0.497	3.80	0.0022	0.0012	0.0005	0.0003	0.0120	15	0.41
2	1	0.45	0.370	4.56	0.0029	0.0010	0.0005	0.0004	0.0120	17	0.32
2	2	0.54	0.395	4.56	0.0028	0.0010	0.0004	0.0005	0.0130	17	0.36
2	3	0.45	0.450	4.60	0.0028	0.0010	0.0004	0.0003	0.0170	16	0.42
2	4	0.35	0.290	4.35	0.0026	0.0010	0.0004	0.0001	0.0160	18	0.44
3	1	0.42	0.365	4.30	0.0028	0.0010	0.0004	0.0002	0.0170	13	0.50
3	2	0.52	0.268	3.90	0.0025	0.0009	0.0003	0.0001	0.0165	12	0.51
3	3	0.52	0.456	3.54	0.0029	0.0009	0.0004	0.0003	0.0170	13	0.41
3	4	0.56	0.321	4.12	0.0029	0.0009	0.0004	0.0005	0.0175	15	0.44
4	1	0.75	0.585	4.25	0.0032	0.0009	0.0007	0.0006	0.0168	10	0.58
4	2	0.70	0.575	4.35	0.0033	0.0012	0.0007	0.0001	0.0168	12	0.71
4	3	0.69	0.548	4.43	0.0032	0.0013	0.0008	0.0002	0.0170	11	0.80
4	4	0.74	0.487	4.35	0.0032	0.0012	0.0007	0.0006	0.0169	12	0.69
5	1	0.65	0.531	3.30	0.0031	0.0012	0.0006	0.0005	0.0167	13	0.17
5	2	0.64	0.534	3.50	0.0033	0.0018	0.0007	0.0008	0.0168	13	0.17
5	3	0.71	0.546	3.60	0.0033	0.0016	0.0008	0.0002	0.0170	15	0.80
5	4	0.62	0.536	3.20	0.0035	0.0019	0.0007	0.0001	0.0177	13	0.69
6	1	0.49	0.170	3.10	0.0034	0.0016	0.0005	0.0008	0.0175	15	0.17
6	2	0.56	0.240	2.50	0.0025	0.0016	0.0005	0.0009	0.0140	15	0.17
6	3	0.50	0.050	2.40	0.0021	0.0015	0.0006	0.0005	0.0148	16	0.21
6	4	0.45	0.190	2.00	0.0025	0.0013	0.0005	0.0004	0.0156	17	0.20

Appendix VIII Nutrient status of fruit in Varyathpadi

Treatments	Replication	N %	P%	K%	Ca %	Mg %	Fe %	Vit.A %	Vit.C %	Crude fibre %	Si %
1	1	0.49	0.49	3.20	0.0023	0.0011	0.0004	0.0002	0.0131	15	0.15
1	2	0.48	0.49	3.20	0.0023	0.0012	0.0004	0.0002	0.0150	16	0.21
1	3	0.49	0.48	3.50	0.0025	0.0010	0.0005	0.0005	0.0140	15	0.14
1	4	0.47	0.50	3.10	0.0024	0.0010	0.0003	0.0006	0.0133	15	0.40
2	1	0.49	0.37	4.25	0.0025	0.0002	0.0003	0.0003	0.0176	16	0.16
2	2	0.48	0.36	4.25	0.0022	0.0016	0.0004	0.0005	0.0156	17	0.28
2	3	0.45	0.37	4.21	0.0006	0.0015	0.0004	0.0004	0.0180	15	0.41
2	4	0.51	0.37	4.13	0.0025	0.0013	0.0005	0.0008	0.0170	16	0.31
3	1	0.47	0.35	3.60	0.0025	0.0019	0.0002	0.0005	0.0178	16	0.40
3	2	0.56	0.36	3.50	0.0024	0.0010	0.0002	0.0006	0.0161	14	0.40
3	3	0.51	0.33	3.90	0.0026	0.0014	0.0002	0.0005	0.0162	14	0.51
3	4	0.54	0.37	3.40	0.0031	0.0012	0.0001	0.0004	0.0159	14	0.32
4	1	0.55	0.57	3.60	0.0035	0.0016	0.0003	0.0002	0.0169	12	0.41
4	2	0.75	0.56	4.45	0.0026	0.0010	0.0005	0.0003	0.0168	13	0.45
4	3	0.70	0.59	4.65	0.0028	0.0012	0.0006	0.0005	0.0159	13	0.40
4	4	0.69	0.55	4.68	0.0026	0.0015	0.0002	0.0009	0.0170	15	0.35
5	1	0.70	0.52	4.65	0.0026	0.0014	0.0003	0.0005	0.0074	13	0.61
5	2	0.68	0.52	3.85	0.0028	0.0016	0.0002	0.0006	0.0171	15	0.52
5	3	0.70	0.25	4.00	0.0031	0.0013	0.0003	0.0008	0.0175	16	0.49
5	4	0.68	0.21	3.21	0.0026	0.0017	0.0004	0.0009	0.0128	16	0.58
6	1	0.71	0.32	3.89	0.0022	0.0010	0.0005	0.0002	0.0135	15	0.10
6	2	0.49	0.11	4.00	0.0021	0.0007	0.0006	0.0009	0.0165	13	0.09
6	3	0.50	0.21	4.10	0.0022	0.0012	0.0002	0.0001	0.0135	16	0.05
6	4	0.48	0.20	3.90	0.0025	0.0015	0.0006	0.0005	0.0125	15	0.08

Appendix IX Yield parameters in Pallikkandam

Treatments	Replication	Length of fruit (cm)	Girth of the fruit (cm)	Number of fruits /plant	Yield/plant (kg)	Yield t/ha	Rotting %
1	1	16.20	16.00	1	0.13	1.15	32
1	2	16.80	15.50	2	0.13	1.27	34
1	3	15.20	15.60	1	0.15	2.20	28
1	4	12.80	15.10	1	0.14	0.87	30
2	1	26.00	26.00	2	1.73	20.50	35
2	2	25.50	25.50	2	1.53	17.30	32
2	3	25.60	27.20	3	1.63	11.20	38
2	4	27.20	26.50	4	1.85	18.00	36
3	1	32.00	31.20	2	1.47	16.80	45
3	2	30.20	30.50	3	1.51	11.50	48
3	3	28.60	30.60	2	1.65	12.80	44
3	4	30.20	32.80	4	1.45	14.77	45
4	1	34.80	34.10	3	2.64	25.80	60
4	2	32.20	35.50	3	2.65	24.50	64
4	3	36.20	34.20	4	2.50	29.50	60
4	4	34.50	33.50	4	2.50	26.42	65
5	1	33.80	32.00	3	2.12	20.85	68
5	2	36.20	32.50	2	2.01	19.50	65
5	3	30.50	31.20	3	1.98	18.90	64
5	4	30.50	33.50	4	2.03	22.80	65
6	1	26.50	26.50	2	1.16	10.56	25
6	2	25.50	25.50	1	0.95	11.59	28
6	3	25.80	26.50	3	1.25	12.68	24
6	4	27.50	28.20	2	1.12	16.80	25

Appendix X Yield parameters in Varyathpadi

Treatments	Replication	Length of fruit (cm)	Girth of the fruit (cm)	Number of fruits /plant	Yield/plant (kg)	Yield t/ha	Rotting %
1	1	20.10	20.10	1	0.12	1.06	30
1	2	21.20	20.10	1	0.11	0.84	32
1	3	21.50	19.50	1	0.15	1.06	35
1	4	19.20	21.50	2	0.13	0.94	35
2	1	23.20	23.10	2	1.25	15.89	35
2	2	22.50	23.50	3	1.25	11.56	40
2	3	24.10	22.60	2	1.50	9.85	35
2	4	23.50	24.60	2	1.30	12.78	36
3	1	28.50	27.50	2	1.14	11.35	40
3	2	26.50	28.20	2	1.20	13.24	45
3	3	27.40	26.50	1	1.30	14.60	45
3	4	30.50	27.80	2	1.40	11.34	47
4	1	32.40	32.00	2	2.05	21.50	65
4	2	34.20	32.50	2	2.25	22.98	65
4	3	31.50	32.30	3	2.12	22.50	70
4	4	35.50	33.50	2	2.23	23.10	60
5	1	30.10	31.00	2	1.66	16.60	70
5	2	32.50	32.20	2	1.56	16.00	75
5	3	28.50	30.50	2	1.70	14.80	65
5	4	30.50	30.50	2	1.52	17.20	65
6	1	25.00	24.50	3	0.95	9.54	20
6	2	24.00	23.50	3	0.85	12.30	28
6	3	26.50	24.50	2	1.10	10.40	28
6	4	22.50	24.50	3	0.94	9.80	25

Appendix XI **Total uptake of nutrients by the crop (kg/ha)**

Treatment	Replication	Total fresh weight t/ha	N	P	K	Ca	Mg	Si
1	1	1.68	1.28	0.54	3.61	0.004	0.0025	0.96
1	2	1.56	1.38	0.53	3.71	0.004	0.0023	1.05
1	3	1.77	1.50	0.59	4.82	0.004	0.0025	1.20
1	4	1.41	1.01	0.44	2.72	0.003	0.0024	0.84
2	1	16.68	4.52	2.65	32.64	0.017	0.0032	1.61
2	2	13.39	5.58	2.49	34.09	0.014	0.0139	3.27
2	3	11.02	3.87	1.89	23.92	0.008	0.0097	2.73
2	4	13.82	4.47	2.12	27.55	0.015	0.0068	2.40
3	1	12.93	5.08	2.37	30.59	0.016	0.0119	3.52
3	2	14.82	5.87	2.48	31.37	0.017	0.0073	3.09
3	3	16.27	5.78	2.39	32.72	0.019	0.0070	3.48
3	4	13.09	6.00	2.59	31.19	0.021	0.0070	2.61
4	1	23.50	7.84	4.94	49.27	0.029	0.0136	4.92
4	2	24.56	9.46	5.47	55.80	0.028	0.0086	5.16
4	3	24.58	9.97	5.90	64.72	0.030	0.0088	4.47
4	4	25.10	9.53	5.51	61.31	0.030	0.0088	4.06
5	1	18.35	8.70	4.15	57.84	0.028	0.0110	9.56
5	2	17.17	7.30	6.41	42.23	0.026	0.0100	5.21
5	3	16.38	8.10	5.71	46.70	0.030	0.0108	5.82
5	4	18.74	8.72	4.95	40.73	0.027	0.0180	6.46
6	1	10.92	4.51	1.75	24.96	0.010	0.0070	1.82
6	2	13.18	3.98	1.12	29.09	0.013	0.0060	1.44
6	3	11.68	4.26	1.53	29.75	0.013	0.0080	1.48
6	4	11.10	3.74	1.26	27.47	0.015	0.0110	1.97

Appendix XIII Nutrient uptake of vine - Pallikandam (kg/ha)

Treatment	Replication	fresh weight of vine t/ha	N	P	K	Ca	Mg	Si
1	1	0.796	1.4035	0.4211	3.5088	0.0035	0.0025	1.7544
1	2	0.883	1.7226	0.4385	3.7585	0.0038	0.003	1.5034
1	3	0.708	1.1175	0.3849	3.2284	0.0032	0.0022	1.8625
1	4	0.466	0.8366	0.2677	1.9243	0.0019	0.0014	0.8366
2	1	1.466	2.2648	0.6972	10.88	0.0058	0.0042	1.3767
2	2	2.66	4.3824	1.2908	19.123	0.0104	0.008	3.1872
2	3	1.541	2.2725	0.7363	9.5447	0.0061	0.0048	1.3635
2	4	1.041	1.5992	0.5026	7.006	0.0043	0.003	1.1423
3	1	2.208	4.0573	0.9692	18.419	0.0113	0.0064	2.1574
3	2	1.875	3.5931	0.8292	15.975	0.0105	0.0069	1.8518
3	3	1.833	3.4511	0.8327	15.338	0.0099	0.006	2.9033
3	4	1.875	2.9581	0.8121	14.522	0.0089	0.0038	2.1783
4	1	2.316	5.2424	1.2848	29.018	0.0103	0.0052	2.5843
4	2	1.875	4.4409	1.0719	24.195	0.0077	0.0046	2.1439
4	3	2.625	5.8565	1.4683	31.709	0.0121	0.0079	2.0916
4	4	2.375	5.5949	1.3297	29.124	0.0111	0.0046	1.5328
5	1	1.958	4.6146	1.1308	27.124	0.0113	0.0042	3.8749
5	2	1.266	3.1338	0.7452	17.642	0.0079	0.0035	1.1607
5	3	1.666	3.9594	0.9455	23.047	0.0103	0.0047	4.4322
5	4	1.514	3.5378	0.8789	20.729	0.0108	0.0041	3.8695
6	1	1.625	2.6349	0.8274	15.283	0.0074	0.0042	2.6349
6	2	0.875	1.438	0.4515	7.9089	0.0039	0.0023	1.3517
6	3	1.375	2.0066	0.6443	12.485	0.0065	0.0042	2.6755
6	4	1.3	2.0025	0.6345	11.383	0.0059	0.0025	2.9511

AppendixXIV Nutrient uptake by vine - Varyathpadi (kg/ha)

Treatment	Replication	fresh weight of vine t/ha	N	P	K	Ca	Mg	Si
1	1	0.625	1.0563	0.3179	2.0916	0.0027	0.0019	0.8994
1	2	0.716	1.2277	0.3745	2.6396	0.0031	0.0023	0.9822
1	3	0.708	1.2741	0.364	3.155	0.0034	0.0022	1.1407
1	4	0.466	0.8344	0.2528	1.5461	0.002	0.0016	0.6953
2	1	0.791	1.4288	0.3572	5.9532	0.003	0.0017	0.6191
2	2	1.833	3.3058	0.7998	13.063	0.0064	0.004	1.8928
2	3	1.166	2.1497	0.4987	7.7389	0.004	0.0024	1.1694
2	4	1.041	2.0561	0.4265	7.9199	0.0035	0.002	0.9291
3	1	1.583	2.744	0.6723	12.622	0.0055	0.0022	1.5321
3	2	1.583	2.901	0.6861	12.801	0.0055	0.0022	0.967
3	3	1.666	3.1291	0.725	13.046	0.006	0.0023	0.9147
3	4	1.75	3.288	0.7555	14.056	0.0058	0.0024	1.004
4	1	2.354	4.1374	1.1239	25.01	0.0086	0.0006	2.1613
4	2	1.583	3.26	0.8581	18.937	0.0067	0.0006	1.4382
4	3	2.083	4.482	1.2981	28.22	0.0086	0.0008	1.328
4	4	2.156	3.9776	1.1001	23.617	0.009	0.0008	1.243
5	1	1.75	3.6812	0.4141	24.446	0.0101	0.0043	0.8628
5	2	1.666	2.4925	2.7417	14.955	0.0069	0.0031	1.1504
5	3	1.583	3.3566	4.0592	19.515	0.0088	0.0036	2.498
5	4	1.541	3.9616	3.4862	18.223	0.0092	0.0042	2.4034
6	1	1.375	2.2049	0.7166	12.347	0.0035	0.0035	1.5434
6	2	0.875	1.3554	0.5153	7.6239	0.0023	0.0024	0.96
6	3	1.283	2.0293	0.5984	11.389	0.0037	0.0031	1.2631
6	4	1.3	1.8207	0.4583	11.866	0.0039	0.0033	1.6571

Abstract

"SOILTESTBASEDFERTILIZERREQUIREMENS FOR ORIENTAL PICKLING MELON (*Cucumis melo* var. conomon)"

By

LAMINA V.K
(2007-11-102)

ABSTRACT OF THE THESIS

Submitted in partial fulfillment of the

requirement for the degree of

Master of Science in Agriculture

(Soil Science and Agricultural Chemistry)

Faculty of Agriculture

Kerala Agricultural University, Thrissur

Department of Soil Science and Agricultural Chemistry

COLLEGE OF HORTICULTURE

VELLANIKKARA THRISSUR- 680 656

KERALA, INDIA

2009

ABSTRACT

The emphasis on soil test based fertilization has become much more relevant in the present scenario of high fertilizer cost and yield maximization programme. Oriental pickling melon (*Cucumis melo* var. *conomon*) belonging to the family Cucurbitaceae is an important vegetable crop of Kerala. The present study was undertaken to test verify the targeted yield equations developed for oriental pickling melon by the AICRP on STCR centre, Vellanikkara of Kerala Agricultural University in farmers' field. For this purpose fields were selected at two locations in Pattikkad area of Thrissur district during the year 2008-09.

Test experiments consisted of six treatments namely, farmer's practice (T_1), package of practices recommendations of KAU (T_2), soil testing laboratory recommendations of Kerala (T_3), STCR recommendations for a yield target of 30 t ha^{-1} (T_4), STCR recommendations for a yield target of 45 t ha^{-1} (T_5) and organics alone (T_6) .

Among the treatments, T_4 (STCR recommendation for a yield target of 30 t ha^{-1}) gave the maximum yield and B/C ratio. Soil, plant and fruit analyses were carried out to study the nutrient interactions in the plant and the quality aspects of the fruit. From the interaction study it was found that the maximum uptake occurs for the nutrient K followed by N and K. Fruit yield as such was influenced by the soil K content. Similarly the plant K content also showed positive correlation with the yield. High N contents in the soil at the harvest stage of the crop negatively influenced the yield. Fruit yield increased with the N content in the fruit. Keeping quality of the fruit decreased as the N content in the fruit increases. Crude fibre content decreased the

rotting percentage of the fruit. Addition of fertilizers increased the vitamin C and Si contents in melon.

From this study it can be concluded that the fertilizer applied as per the targeted yield equations is contribute much towards the crop requirements for good yield. However future works have to be done in several other locations before the recommendation of these equations.