Pak. J. Bot., 44(1): 161-164, 2012.

PRELIMINARY STUDIES ON MORPHOLOGICAL DIVERSITY OF COCONUT (*COCOS NUCIFERA* L.) SEEDLINGS BY ORGANIC AND INORGANIC FERTILIZER AMENDMENTS AT KARACHI, PAKISTAN

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Abstract

The study was undertaken to determine the effect of organic and inorganic fertilizers amendments on the growth parameters of coconut seedlings in field at the Coastal Agricultural Research Station, Karachi. The seedling height and number of leaves were significantly high in treatment T7 (Neem seed powder) (27.62 ± 8.74) and treatment T5 (NPK) (27.18 ± 8.60). The maximum number of the roots was observed in T1 (NPK + Neem seed powder + *Gliricidia sepium*) (2.26 ± 0.71) and T3 (NPK + *Gliricidia sepium*) (1.69 ± 0.53), where as minimum roots was recorded in T8 (Control) (0.94 ± 0.29). The maximum number of leaves was observed in T4 (Neem seed powder + *Gliricidia sepium*) (1.49±0.47) and T1 (1.31±0.41). The results showed the beneficial effects of organic and inorganic fertilizers on seedlings. The work indicated morphological diversity of seedlings at the nursery stage to help the growers in choosing planting materials for their gardens in coastal area of Sindh and Balochistan.

Introduction

Coconut (*Cocos nucifera* L.) is currently grown in nearly 90 countries spread along the tropical belt. Of the 11.9 million hectares of coconut grown in the world, eight million hectares, or about 70% is in South East & East Asia (Carpio, *et al*., 2005). The coconut is not indigenous to Pakistan, which had no or very little information on variety or specific characters. The seedlings produced in nurseries came from nuts imported from other countries (Laghari & Solangi, 2005).

Coconut is a cross-pollinated perennial crop, which can be propagated only through seeds and the selection of the planting material is of a vital importance. The coconut seed takes a long time before it attains a stable level of production. Proper selection and planting of good quality seed nuts must be done to ensure a productive plantation (Magat, 1999). Palm seeds will need a resistant structure in order to be able to spend a long time in winter and for this reason their shells are quite hard. They need more nourishment then normal or their long journeys and the exact quantity of food necessary is placed inside the coconut seed-package. Coconut seedlings grow and develop faster when fertilized with a combination of ammonium sulfate + potassium chloride + 1gram of Borex (Santos, 1987). Soil is a mixture of organic and inorganic materials. The organic part consists of living things and their remains while the inorganic part is made up of rocks and minerals. Tenkoon & Bandara (2003) observed that organic materials (Cattle manure, goat manure, Broiler & Layer poultry manure, Pig manure, farm yard manure, biogas residue, sewage sludge, compost, *Gliricidia, Pueraria, Calopogonium* and *Acacia*) have considerable amounts of macro and micro-nutrients and these materials could be used as a source of plant nutrients for coconut to supply the N requirement in full and P, K and Mg requirements in part. *Gliricidia* planted in coconut plantation through seeds and cuttings had better biomass production of cuttings as compared to seeds (Solangi *et al*., 2010). Sumbak (1970) studied that more frequent or heavier N applications might be necessary for maximum growth whereas intervals between S applications could be prolonged. The relative poor growth over the first 12 months of seedlings transplanted with 4-7 leaves showed a need for better establishment techniques.

Menon & Pandalai (1960) concluded from their studies that soaking of seed nuts in water for period up to 15 days resulted in quicker and better germination. Injection of major nutrients like N, P and K into the husk was also found to have adverse effects on the germination of seed coconuts. According to the international criteria (Anon., 1980) only 30 percent of the total field contained adequate organic matter. Beside many beneficial effects on soil properties and plant growth, soil organic matter is also indicative of N supply status of soils.

Indian Council of Agricultural Research (Anon., 2004) recommended the soils which are poor in organic matter, the application of green manure or compost at 50kg per/palm. As such it spent entire life span of 70-80 years or more rooted in one place. Consequently it removes most of the available nutrients in the soil within a few years. Annually, the palm removes large quantities of nutrients from the soil (Nathanael, 1961; Von Uexhull, 1971). Balakrishna (1975) studied that all the inorganic and organic fertilizers mixture treatments have consistent and significant effects on the yield. Mravilla *et al*., (1978) noted that the non responsiveness to fertilization of seedlings in the early nursery stages could be due to the already sufficient levels of nutrients available while they were still in the endosperm stage. This is likely so with seedlings collected from adequately nourished or properly fertilized palms.

Therefore the main objectives of this study were to examine the effects of organic and inorganic fertilizers amendments on the germination of coconut seeds and the growth & measurable characters of seedlings viz. the height, total number of leaves, petiol length, ranches length and number of roots.

Material and Methods

The experiment was conducted to study the effect of organic and inorganic fertilizers on the coconut seedlings at Coastal Agricultural Research Station, Saleh Muhammad Goth, Karachi. The station is situated at about 11km from

the Jinnah Terminal Air Port, Karachi Pakistan. The area is nearly plain. Climatically, it falls under humid type and forms a part of the coastal area. Data shows average annual temperature (32.9-21.6ºC), humidity (76.8-49.2%) and rain fall (465.6mm). These values were calculated as mean value of 2007 (Anon., 2007).

Thirty brown seed nuts of uniform size and maturity selected from the Sri Lanka Tall variety of coconut were planted horizontally on raised plots (size 10′x10′) at a spacing of 45cm between seeds and 90cm between rows. A pathway of 60 cm separated each plot to facilitate irrigation and drainage. The beds were irrigated twice a week.

The details of the treatments are as T1 (NPK + Neem seed powder (NSP) + *Gliricidia sepium* (GS) (1 + 0. 5 + 1) kg +(10kg) + (20kg) per/plot; T2 (NPK + Neem seed powder) (1 +.5 +1) + (10kg) kg per/plot; T3 (NPK + *Gliricidia sepium*) (1 + 0.5 +1) kg + (20kg) per/plot; T4 (Neem seed powder + *Gliricidia sepium*) (10kg + 20kg) per/plot; T5 (NPK) (1 + 0. 5 +1) kg per/plot; T6 (*Gliricidia sepium*) (20kg) per/plot; T7 (Neem seed powder) (10kg) per/plot; T8 (Control).

The number of days taken by each nut for germination after planting was recorded and the average for each plot was calculated. A seed nut was reckoned as germinated when the plumule emerged 1cm out of the husk. The measurable characters of seedlings were recorded like i.e., the height, total number of leaves, petiole length, ranches length and number of roots, 13 months after planting of the seed nuts, seedlings attained sufficient growth for transplantation in the permanent field (Santos, 1987; Anon., 1996).

The experiment was laid down in a randomized block design with eight treatments and three replications. The data were subjected to statistical analysis following Steel *et al*., (1997).

Results and Discussion

The data on growth parameters viz., length of plant, total number of leaves, petiole length, ranches length and number of roots are given in Table 1. The seedling height was significantly high in Treatment T7 (Neem seed powder) (27.62 ± 8.74) and treatment T5 (NPK) (27.18 ± 8.60) where as minimum height was recorded in T1 (20.45 ± 6.5). The maximum number of the roots were observed in T1 (NPK + Neem seed powder + *Gliricidia sepium*) (2.26 ± 0.71) followed by T3 (NPK + *Gliricidia sepium*) (1.69 ± 0.53), whereas minimum roots number was recorded in T8 (Control) (0.94 ± 0.29). The maximum number of leaves were observed in T4 (Neem seed powder + *Gliricidia sepium*) (1.49 ± 0.47) followed by T1 (1.31 ± 0.41) and T5 (1.28 ± 0.40). In length of plants and number of roots all treatments were better to control.

Table 1. Growth of 12 month old seedlings from mother palms fertilized with organic and inorganic fertilizers.

Treatments	Length of plants (cm) ± SE	Number of leaves ± SE	Petiol length (cm) ± SE	Ranches length (cm) ± SE	Number of roots ± SE
T1 (NPK + NSP +GSL)	20.45 ± 6.5	1.31 ± 0.41	5.94 ± 1.87	9.90 ± 3.13	2.26 ± 0.71
T2 (NPK + NSP)	23.68 ± 7.48	0.91 ± 0.29	5.64 ± 1.78	10.42 ± 3.29	1.42 ± 0.45
T3 (NPK + GSL)	22.7 ± 7.18	0.84 ± 0.26	5.37 ± 1.70	14.72 ± 4.65	1.69 ± 0.53
T4 (NSP +GSL)	23.80 ± 7.53	1.49 ± 0.47	12.08 ± 3.82	7.04 ± 2.22	1.50 ± 0.47
T5(NPK)	27.18 ± 8.60	1.28 ± 0.40	7.17 ± 2.27	8.19 ± 2.59	1.59 ± 0.50
T6 (GSL)	24.56 ± 7.77	0.82 ± 0.26	9.41 ± 2.98	13.56 ± 4.29	1.64 ± 0.52
T7 (NSP)	27.62 ± 8.74	1.0 ± 0.31	5.25 ± 1.66	10.24 ± 3.24	1.33 ± 0.42
T8 (Control)	18.96 ± 6.0	1.26 ± 0.40	7.82 ± 2.41	16.21± 5.13	0.94 ± 0.29

Mean with ± slandered error of 3 replicates

T1= NPK + Neem seed powder (NSP) + *Gliricidia sepium* (GS), T2= NPK + Neem seed powder, T3= (NPK + *Gliricidia sepium*), T4= (Neem seed powder + *Gliricidia sepium*), T5= NPK, T6 =*Gliricidia sepium,* T7 = Neem seed powder, T8 = Control.

It was observed that organic and inorganic fertilizers improved the growth parameters of coconut seedlings. Similar results were obtained by Aiyaduraj (1954), who found that organic mulches promoted early and better germination, healthy growth and high percentage of good seedlings. This result is also supported by the findings of Magat (1999) who reported that the 1 tbsp (Table spoon) of ammonium sulfate plus 1 tbsp of Muriate of potash or 2 tbsp each of both ammonium sulfate and Muriate of potash must be applied per seedling for the fifth month. Liyanage & Abeywardena (1957) concluded that the seedling vigour was highly correlated with adult palm characters such as early flowering, nut yield and copra production. Kannaiyan & Parsad (1974) also reported that the addition of organic matter to soil is known to stimulate saprophytic fungi in soil and saprophytic fungi play an important role in the decomposition of tignocellulosic organic matter. Jithya (2010) concluded that the fertilizer application is mainly based on chemical fertilizers which are costly and exerts negative impacts on soil health. No significant difference was observed in growth parameters (seedling girth, seedling height, number of leaves and leaf area) in treatments like inorganic fertilizer mixture, BioGoldA, Cattle manure, Kochchikade biofertilizer and compos.

The results presented in Table 1 revealed that the maximum number of roots was observed in T1. These results are in agreement with Thomas (1973), who observed that the coconut palm with developed root system is invariably better yielder than those with scanty roots. In the case of aged seedlings with lesser food reserve the transplantation shock and root injury will be considerable and will lead to delayed establishment in the field. It has been observed that the seedlings begin to take up nutrients immediately after the emergence of the first roots which is about 14 weeks from sowing. At the stage

two three roots must have appeared with a number of rootlets. Reddy *et al*., (2001) observed the number of roots per seedling was significantly higher in sand + vermi compost, sand + PK + Biofertilizer, Potting mixture and sand + NPK + Biofertilizer compared to sand and sand + NPK. Coconut palm has neither tap roots nor root hair but has a fibrious root system (Thampan, 1990). Margate & Magat (1988) indicated that the growth of seedlings at the nursery stage likely depended on the nutrition of the mother palms.

The results of the neem cake and neem cake powder applied as a fertilizer in soil which do not disturb the natural balance of symbiotic and non-symbiotic nitrogen fixing bacteria, thus maintaining the fertility status of the soil (Shahida *et al*., 2002). The leaves of G*liricedia* decompose relatively fast, providing nitrogen and potassium and the application also improved the soil moisture availability (Subramanain *et al*., 2005). Liyanage (1953) reported that the essential points to be noted during selection of seedlings are early germination, early splitting of leaves in to leaflets. Short and thick leaf stalks, healthy and robust appearance, having minimum of six leaves and collar girth of 10cm at one year age. Proper selection of seedling in the nursery alone ensures 10% improvement in yield. Marimuthu & Natarajan (2005) observed that to get more quality seedlings, the seed nuts are to be cured for one month in open shade followed by sand curing for 2 or 3 months. Chattopadhyay *et al*., (2004) compared 5 seed sizes ranging 600-1100g and 2 planting methods viz., horizontal and vertical and concluded that horizontal planting with higher weight of seed nut recorded early and maximum germination and more seedling vigour.

Application of *Gliricidia sepium* was shown to increase the soil nitrogen levels in the top soil then in the sub-soil. However, *Gliricidia* planted with in the rows of coconut plants and has shown that the nitrogen level has increased in the topsoil as well as sub soil (CRI, 1993). Among multipurpose tree species, *Gliricidia sepium* gave the highest fresh biomass yield of approximately 10 kg/tree. It has also showed a high cropping ability giving 41 sprouts-trees (Liyanage & Bastian, 1993). Nematicidal property of *Gliricidia sepium* extract was observed in different concentrations against *Meliodogyne incognita* nematode showing 60% mortality (Nazli, *et al.*, 2008).

According to the Thampan (1990) that management of the nursery involves the creation of optimum conditions for the early and maximum germination of seed nut and subsequent healthy growth of seedlings. Optimum conditions are provided by attending to regular irrigation, weeding, mulching and control of pest and disease. Crop yield efficiency depends on the available nutrients status of the soil (Khan *et al*., 2009). Present study finds that T1 has best doses of organic and inorganic fertilizers for coconut seedling growth under agro climatic condition of Karachi. The results indicate that the growth of seedlings at the nursery stage likely depended on the nutrition of the mother palms. So if the seeds could be germinated quickly, the nursery period can be shortened and the cost of production of seedlings reduced. Early germination is an important factor to be taken in to consideration in the selection of the seedlings. The seedling should be frequently examined for insect attack or fungus disease and the necessary remedial measures should be adopted promptly. Application of farmyard manure to soil has been practiced for many centuries and its application to soil has increased crop yield, improved soil fertility, increased soil organic matter, increased microbiological activities and improved soil structure for sustainable agriculture (Blair *et al*., 2006).

This preliminary study indicated that the coconut seeds germination was better in treatment 1. It seems that organic manure enhanced the uptake of N, P and K and improved the fertility status of the soil. Combine treatments being a very simple and easy can be well recommended to growers to raise the seedlings. The practice if adopted can cope-up the nutritional requirement of seedlings at nursery stage and considerably reduce the nursery period resulting in a lower cost of production of seedlings and can produce well healthy seedlings for plantation in the garden.

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(Received for publication 8 November 2010)