GROWTH AND SURVIVAL OF CONTAINERIZED MOLUCCAN SAU SEEDLINGS GROWN IN ORGANIC CONTAINERS

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ABSTRACT

Moluccan sau seedlings grown in coir dust container under greenhouse conditions performed better in terms of height, diameter, number of leaves and shoots than those grown from bagasse, rice straw and sawdust materials. However, in the field phase, rice straw container-grown seedlings attained the highest growth (height and stem diameter) six months after field planting. Early biodegradation of the containers as well as the nutrient content present in the materials hastened the growth of the seedlings. However, such effect on growth was not sustained when the containers completely degraded between the fifth and sixth month. All the treatments did not significantly affect the survival of seedlings during the first to sixth month after planting.

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KEY WORDS: Moluccan sau. *Albizia falcataria.* Organic container. Growth and survival.

INTRODUCTION

The quantity of unutilized wood and agricultural residues in the form of sugarcane bagasse, rice straw, coconut husks and wood sawdust are enormous. It is estimated that some 214 million tons of sawdust and 1.6 billion tons of coconut husk (coir dust) are generated annually. Researches made on their utilization show that these waste materials can be converted into useful products such as pulp and paper forage and silage, and fertilizer from bagasse; wall decorations, fuel and insulation materials from coconut husk; charcoal briquettes, fertilizers, fiberboards, pulp cushioning, absorbent and packaging materials, oilfire extinguishers and ice insulators from sawdust; and feeds from rice straw.

In the Philippines, the slow pace of reforestation may be attributed to low survival and slow growth of planted seedlings due to lack of moisture available to the seedlings during the dry season, coupled with the submarginal soil conditions prevailing in most open lands, and competition with grass and/or weeds for space, light and soil nutrients. These prevailing conditions naturally lead to the practice of replanting as many as three or four times every year (Domingo, 1976).

This study dealt with the use of sugarcane bagasse, rice straw, coconut husk and sawdust for container to produce containerized seedlings.

MATERIALS AND METHODS

Locally collected moluccan sau seeds *[(Albizia falcataria* (L.) Fosb.*]* were used in this study. This species is extensively planted in most open lands under reforestation projects because of its fast growth and many uses.

This study consisted of two phases. The first phase involved the manufacture of the containers and the greenhouse testing of container-grown seedlings while the second phase involved the outplanting and/or field testing of container-grown seedlings.

Nursery and Greenhouse Phase. — Moluccan sau seeds secured from Cebu Reforestation Project were stored in a tightly sealed container to prolong their viability. Before planting, the seeds were treated with hot water to insure prompt germination and uniform age of seedlings. The treated seeds were pre-germinated in a wet cloth prior to sowing.

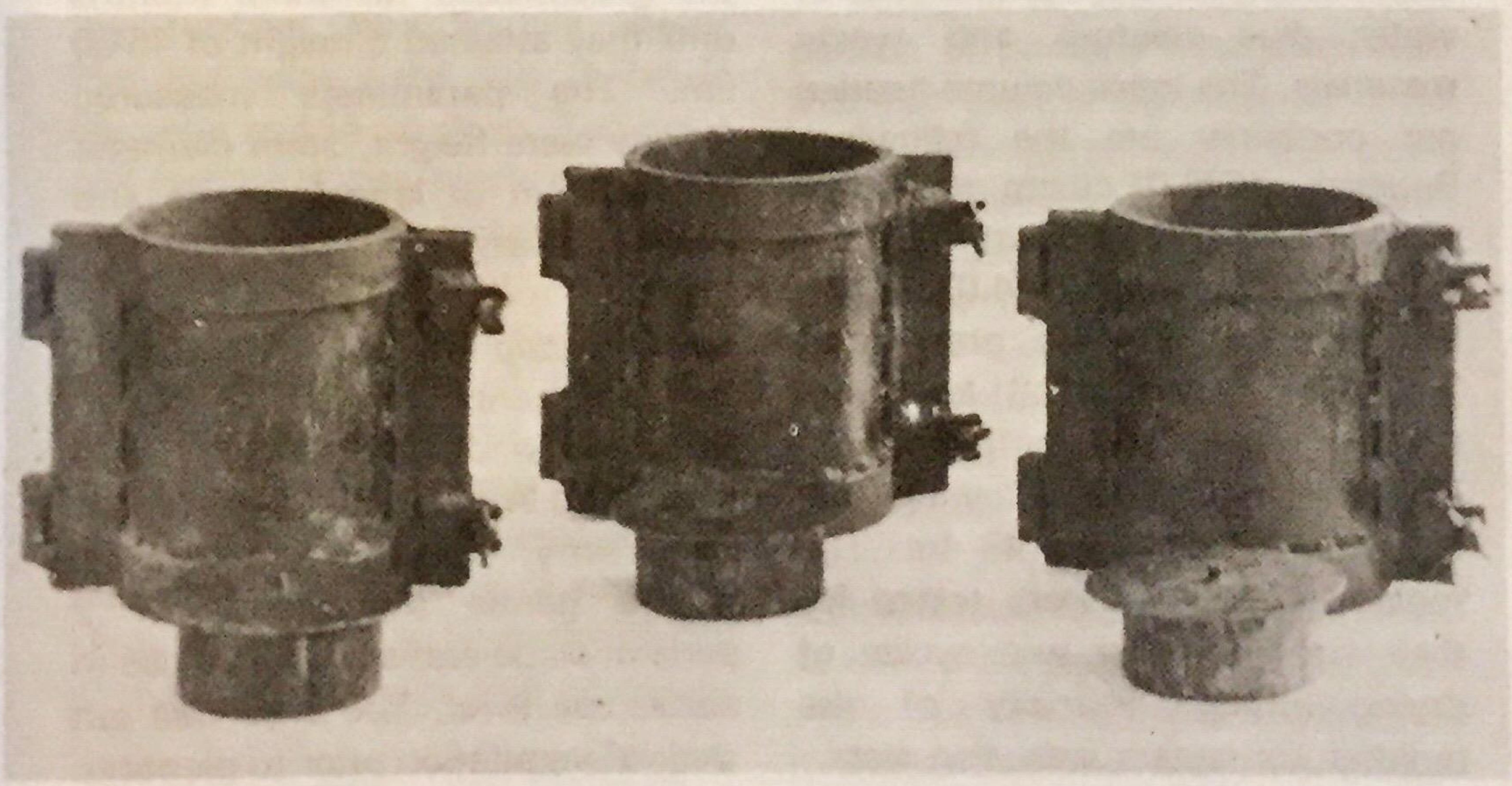

Fig. 1. Metal molders used in the manufacture of seedling containers using bagasse, rice straw, sawdust and coir dust (30x).

Table 1. Nutrient analysis of the four materials used as containers.

Parameter	Bagasse	Rice Straw	Coir Dust	Sawdust
Moisture content (%)	3.23	3.94	1.96	6.97
pH	6.10	7.20	6.20	5.80
Organic matter (%)	6.40	17.20	8.40	2.80
Nitrogen (%)[1]	0.32	0.86	0.42	0.14
Phosphorus (ppm)	930.00	1000.00	998.00	920.00
Potassium (ppm)	1000.00	4100.00	2300.00	1500.00

[1]Based on % organic matter.

Cylindrical metal molders, 10.16 cm in diameter and 12.70 cm in height, were prepared to mold the materials into containers (Fig. 1). The four materials were ground, air dried, screened and analyzed to determine their nutrient contents (Table 1). The mixture of the materials by volume was selected after testing different proportions of water glue mixture and waste materials. The loose volume needed per container are the following: Bagasse - 4576.01 cu cm, rice straw - 2941.63 cu cm, coir dust - 4118.54 cu cm, and sawdust 2574.07 cu cm. The 4 mixtures were pressed at 2.46, 6.98, 13.03 and 2.31 kg/cu cm for 2 hr, respectively, before removing the mold and allowing the materials to dry for 48 hr. The molded containers were tested for their strength after two cycles of drying-wetting. Porosity of the molded containers was also determined by paraffin test.

Pre-germinated seeds with radicles coming out were directly sown singly in the containers. The seeded containers were kept in the greenhouse and hand-watered regularly. Containers in which pre-germinated seeds did not develop were reseeded to meet the required number of seedlings in the field phase. The seedlings were kept in the greenhouse for three months until they attained a height of 15-30 cm. The parameters measured weekly were height, stem diameter and number of lateral shoots and leaves/leaflets.

Field Testing Phase. — The field test was conducted in the experimental area of the Visayas State College of Agriculture, Department of Forestry, ViSCA, Leyte. The site has a gentle topography of 2 percent slope and elevation of 65 m above sea level. The area was cut clear of vegetation prior to planting.

Soil samples were also taken from the area after site preparation.

Samples from surface (0-6 cm) and sub-surface (6-10 cm) soil were collected at random for the determination of pH, organic matter, total nitrogen, phosphorus and potassium.

The study was set in a randomized complete block design (RCBD) in an area measuring 1400 sq m. There were four blocks (replications), each measuring 320 sq m. Four treatments were randomly assigned to each block.

T_1 - Bagasse container-grown seedlings
T_2 - Rice straw container-grown seedlings
T_3 - Coir dust container-grown seedlings
T_4 - Sawdust container-grown seedlings

Furrows were oriented from north to south and spaced at 2 m from each other. The container-grown seedlings were planted along the furrows two meters apart. Planting holes were dug 10 cm in diameter and 14 cm deep. Ten holes per treatment per block were prepared. The distance between experimental units was 2 m. For every block, 20 seedlings per treatment were randomly planted making a total of 320 plants for the entire experiment. Percentage survival, height and stem diameter of the seedlings were noted once a month. Likewise, monthly biodegradability of the container was also recorded.

RESULTS AND DISCUSSION

Nursery and Greenhouse Phase

Plant Height and Stem Diameter (cm).

Seedlings grown in coir dust container were consistently taller and developed the biggest stem diameter compared with those placed in the three other container preparations during the three-month period (Fig. 2 and 3). Analysis of variance on height showed highly significant differences among seedlings grown in four kinds of containers for three months. However, variation in stem diameter was only significant during the second and third month. Seedlings grown in coir dust were significantly taller and bigger than those grown in the other containers. The differences in seedling growth may be attributed to the differences in porosity, pH, nitrogen, phosphorus and potassium contents of the materials used (Table 2).

Analysis of variance and comparison of porosity means showed that coir dust is significantly more porous compared with the three other containers used. The computed values for porosity as related to height ($r=0.86$) and diameter ($r=0.82$) were higher than their tabulated values ($r=0.811$) at 5 percent significant level. On the other hand, the values for r computed for pH, nitrogen, phosphorus and potassium were lower than their tabulated values. Probably porosity of the medium container significantly influenced the height and diameter of the seedlings rather than pH and nutrients present in the

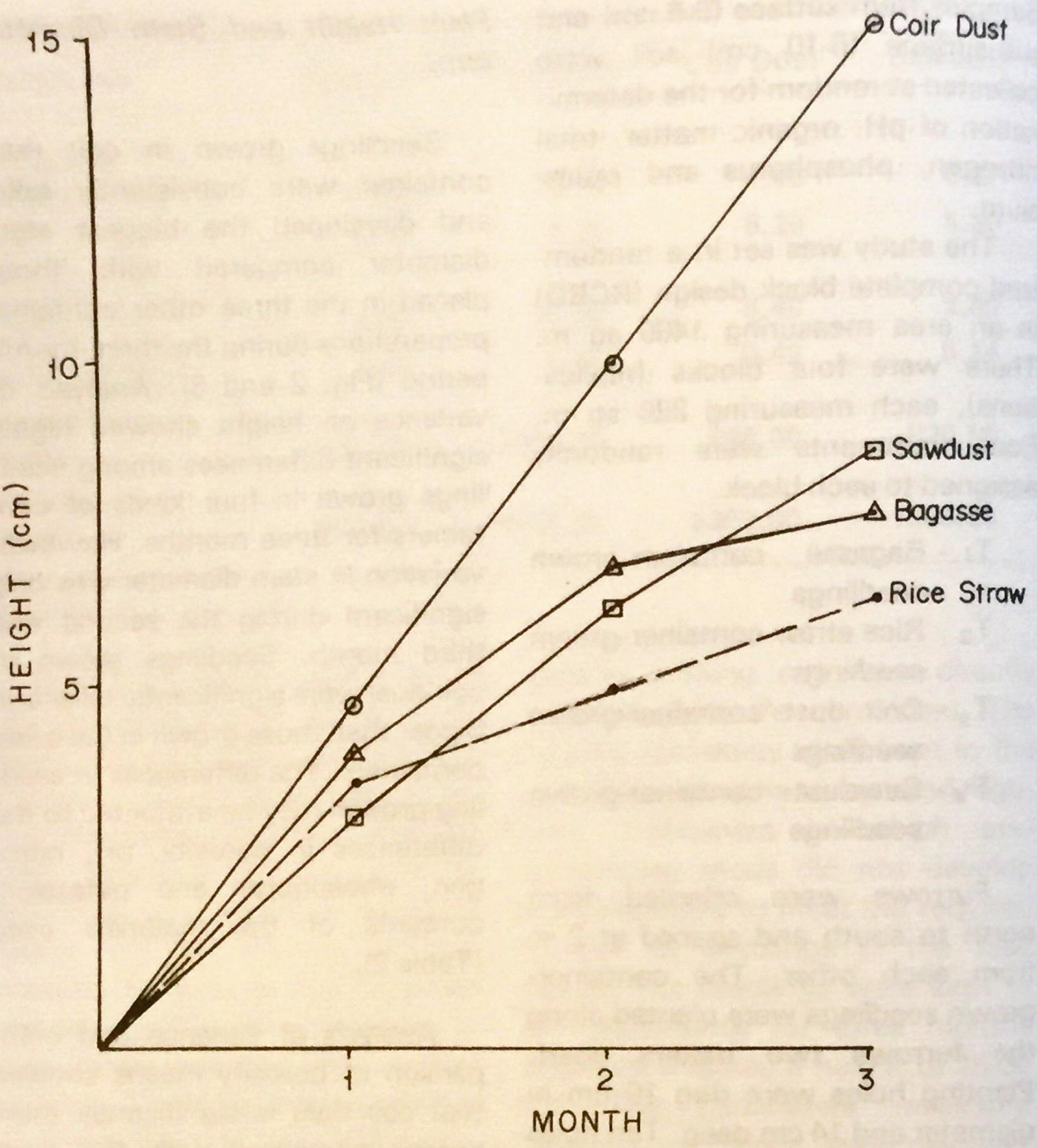

Fig. 2. Height (cm) of moluccan sau seedlings grown in different containers in the greenhouse.

materials. The nutrients present in the materials were perhaps not yet fully available for plant growth when the seedlings were still in the greenhouse. Mustanoja and Leaf (1965) explained that the N, P and K contents of a medium are unavailable or very slowly available to plants in an organic form. A porous medium provides favorable growing condition for root processes such as respiration, absorption of water and nutrients and root formation. The same idea was pointed out by Camon (1952) that the more porous the material, the more roots are formed and consequently greater water absorption for normal plant growth.

The slow growth rate (height and diameter) of seedlings grown in sawdust, rice straw and bagasse containers may be due to low porosity. Brady (1974) reported that low porosity results in restricted growth particularly of smaller roots of young seedlings. Under poor aeration, plants exhibit sluggish water uptake resulting in slow growth. Kramer and Kozlowski (1960) claimed that deficiency of oxygen in the soil often causes cessation of root growth together with injury to or death of root system.

Number of Lateral Shoots and Leaves/Leaflets.

Comparison of the number of lateral shoots and leaves/leaflet means revealed that seedlings grown in coir dust have significantly developed more shoots and leaves than those grown in rice straw containers (Table 3). Analysis of variance on the number of lateral

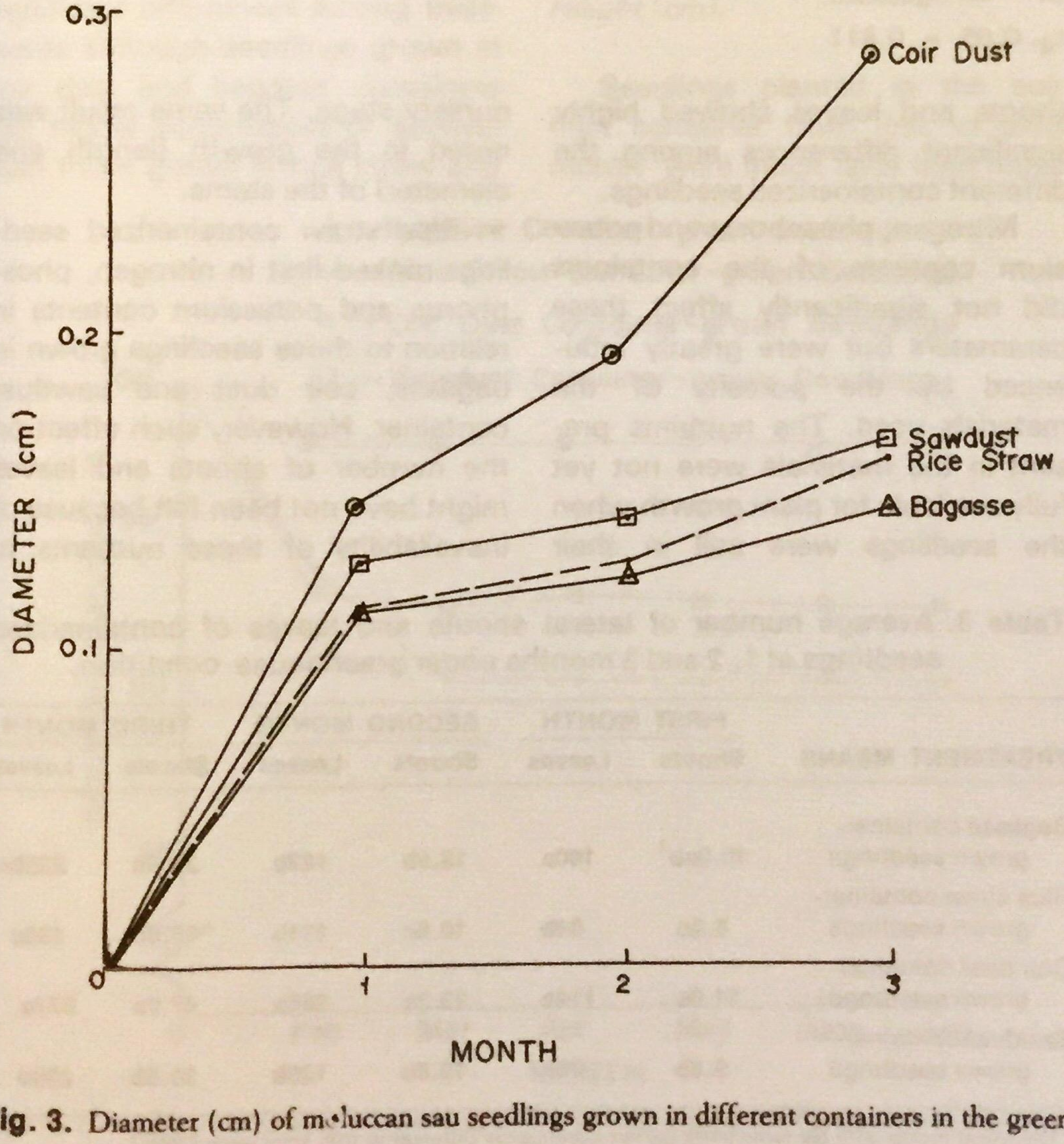

Fig. 3. Diameter (cm) of moluccan sau seedlings grown in different containers in the greenhouse.

Table 2. Correlation analysis of pH, N, P, K and porosity affecting height and diameter and number of lateral shoots and leaves of Moluccan sau seedlings.

Parameter	Height	Diameter	Number of Shoots	Number of Leaves
ph	-0.37^{ns}	-0.14^{ns}	-0.69^{ns}	-0.38^{ns}
N (%)	-0.28^{ns}	-0.03^{ns}	-0.61^{ns}	-0.29^{ns}
P (ppm)	0.34^{ns}	0.56^{ns}	-0.86^{ns}	0.33^{ns}
K (me/100 g)	-0.17^{ns}	0.06^{ns}	-0.61^{ns}	-0.18^{ns}
Porosity (%)	0.86^{*}	0.82^{*}	0.83^{ns}	0.86^{*}

* = significant at 5% level.

ns = not significant.

$r_{4}, 0.05 = 0.811$

shoots and leaves showed highly significant differences among the different containerized seedlings.

Nitrogen, phosphorus and potassium contents of the containers did not significantly affect these parameters but were greatly influenced by the porosity of the materials used. The nutrients present in the materials were not yet fully available for plant growth when the seedlings were still in their nursery stage. The same result was noted in the growth (length and diameter) of the stems.

Rice straw containerized seedlings ranked first in nitrogen, phosphorus and potassium contents in relation to those seedlings grown in bagasse, coir dust and sawdust container. However, such effect on the number of shoots and leaves might have not been felt because of inavailability of these nutrients to

Table 3. Average number of lateral shoots and leaves of containerized seedlings at 1, 2 and 3 months under greenhouse condition.

TREATMENT MEANS	FIRST MONTH		SECOND MONTH		THIRD MONTH	
	Shoots	Leaves	Shoots	Leaves	Shoots	Leaves
Bagasse container-grown seedlings	10.0ab[1]	100a	13.5b	142b	20.3b	225bc
Rice straw container-grown seedlings	8.5c	84b	10.8c	111b	15.0b	136c
Coir dust container-grown seedlings	11.0a	114a	23.3a	288a	47.0a	677a
Sawdust container-grown seedlings	9.8b	78b	13.8b	125b	20.5b	290b

[1] Treatment means with the same letter are not significantly different at 5% level using DMRT.

the seedlings as the containers were still in their organic form.

Since coir dust is significantly porous compared with the other three containers, seedlings grown using this medium were favored to have numerous lateral shoots and leaves.

Field Phase

Survival of Seedlings.

Analysis of variance showed no significant differences among treatments although seedlings grown in coir dust and bagasse containers had higher percentages of survival than those grown in rice straw and sawdust containers (Fig. 4). Generally, the highest percentage of survival of the seedlings may be attributed to the undisturbed and well-developed intact root systems during and after planting. This conforms with the findings of Jackson (1974) and Owston (1973). Shreve (1974) also asserted that intact and undisturbed roots accounted for superior survival of containerized seedlings over non-containerized ones.

Height (cm).

Seedlings planted in the coir dust container from first to third month were much taller than those

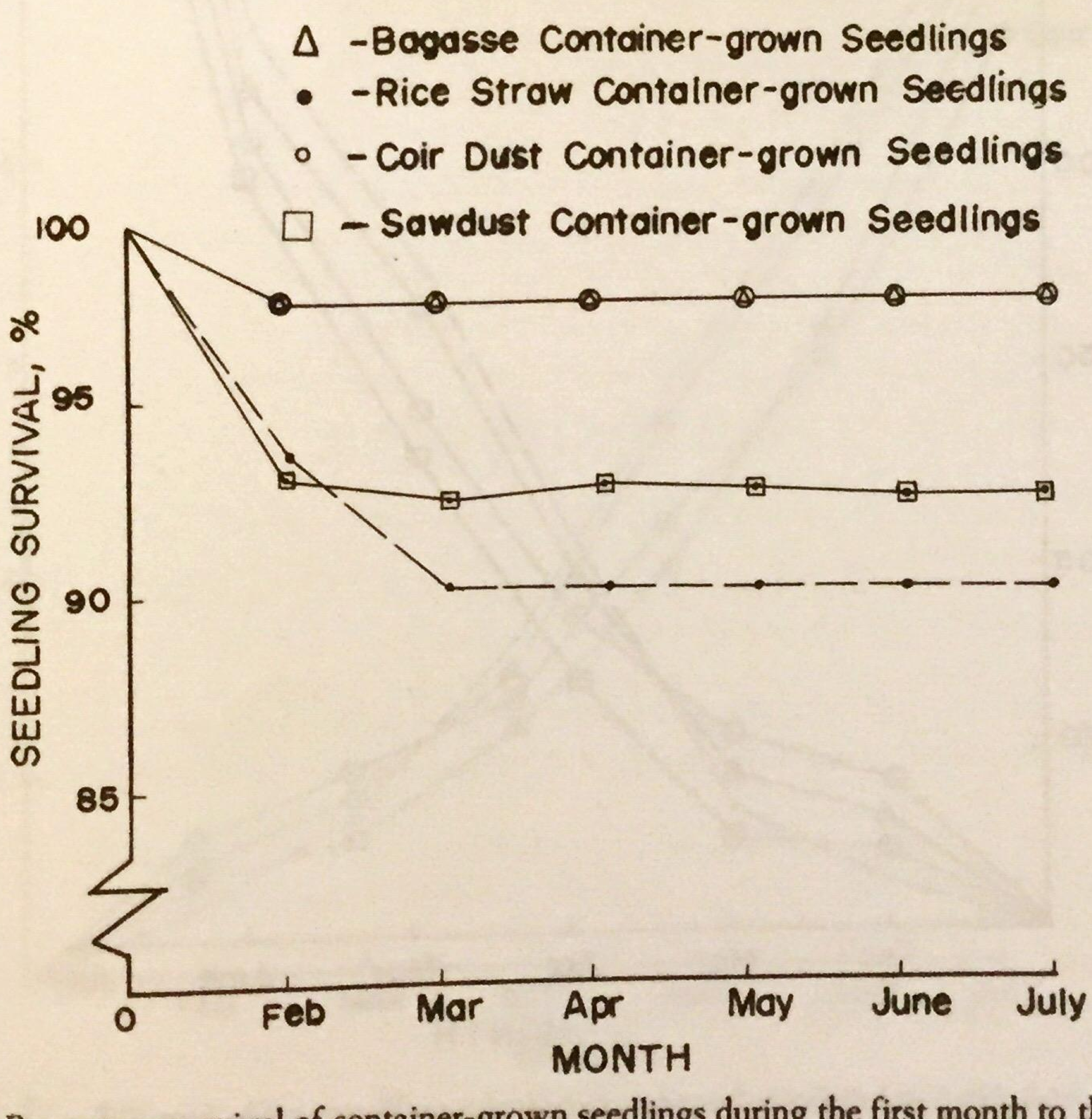

Fig. 4. Percentage survival of container-grown seedlings during the first month to the sixth month after planting in the field.

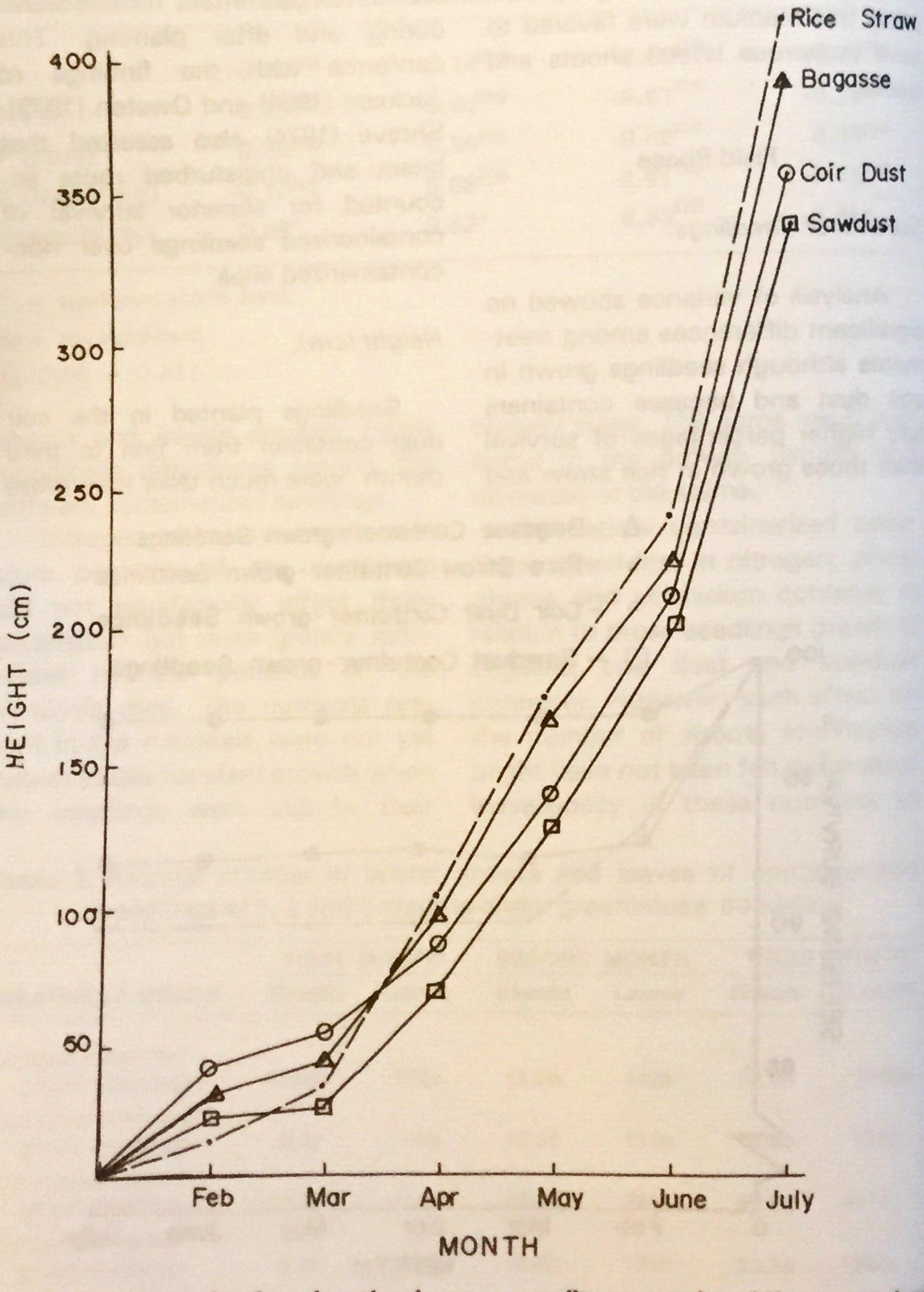

Fig. 5. Monthly height of outplanted moluccan sau seedlings using four different container materials.

grown in the other three container materials (Fig. 5). However, during the fourth month, the growth pattern changed in favor of rice straw containerized seedlings. On the sixth month, no significant differences were observed in the seedlings in the four containers. This result was probably due to the adaptability of the plants to the area as they were already established in the field and completely dependent on the native fertility of the soil. The roots of the seedlings had penetrated farther and deeper into the soil such that the absorbing regions were no longer dependent on the container.

Stem Diameter (cm).

It was observed that differences in diameter during the first month were not as great in magnitude as the differences in height (Fig. 6). From the second to the sixth month after planting, no significant differences were observed among the seedlings grown in the four types of

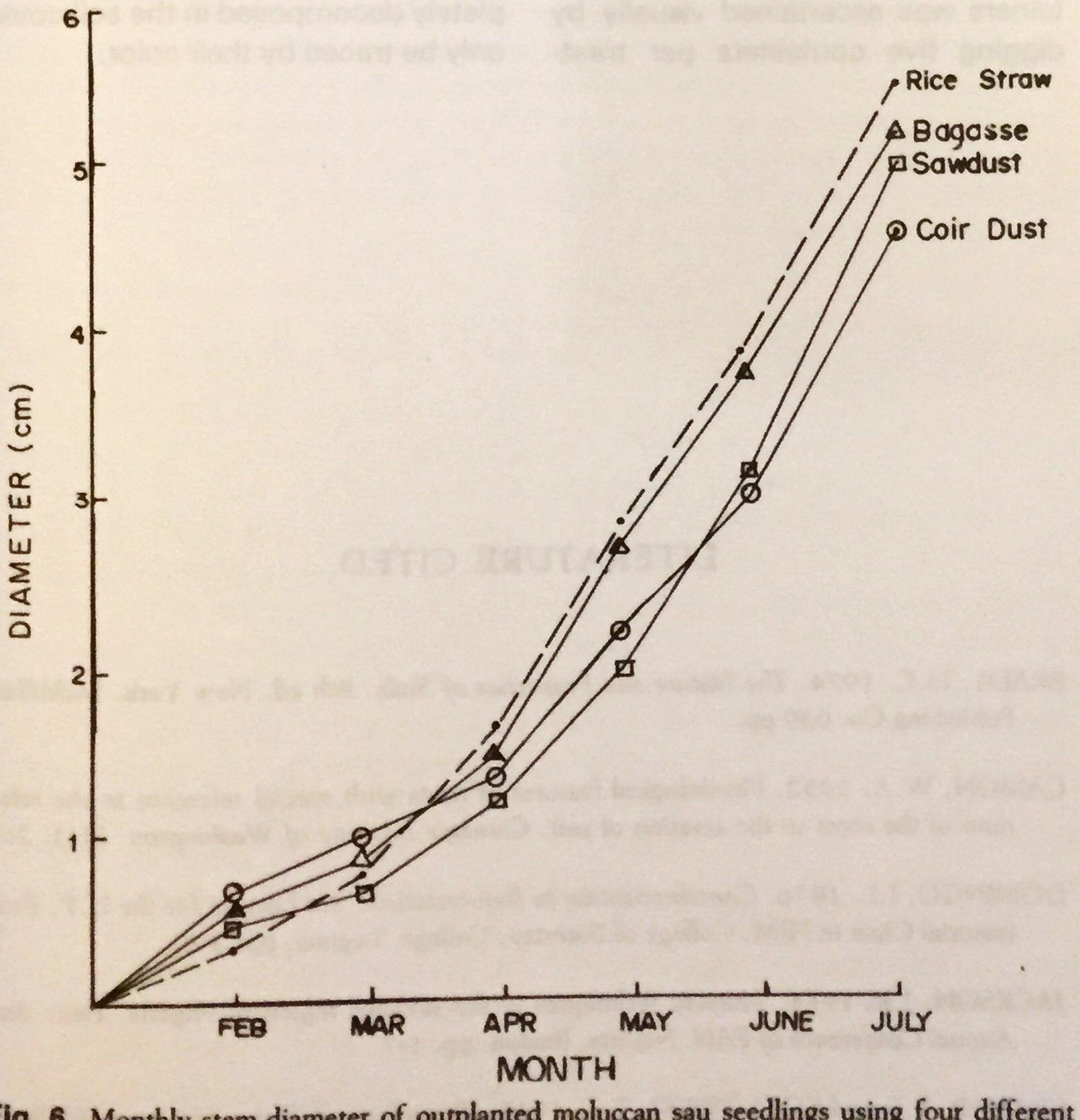

Fig. 6. Monthly stem diameter of outplanted moluccan sau seedlings using four different container materials.

containers. Smith (1962) observed that increase in stem diameter of plants at their young stage does not vary much compared with the increase in height. This was further supported by Kramer and Kozlowski (1960), who reported that generally trees increase in diameter for a longer period of time than they grow in height.

Degradation of Container Materials.

Monthly degradation of the containers was ascertained visually by digging five containers per treatment every month.

During the first and second month, there were no visible changes in the physical appearance of the container. However, rice straw containers started to decompose in the early part of the third month and appeared to be in advanced stage of decomposition as compared with the other three materials during the later part of the fourth month.

On the fifth and sixth month, the organic containers which were completely decomposed in the soil could only be traced by their color.

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