3. MATERIALS AND METHODS

The present study was carried out to find and evaluate alternative system to plastic trays for rice nursery which ensure low costs with high efficiency.

Nursery and field experiments were carried out during the agricultural season of 1996, in Meet El-Deeba Kafr El-Sheikh Governorate.

3.1. MATERIALS :

3.1.1. Wood Species :

Two wood species Eucalyptus camalulensis Dehn. (eucalypt) and Casuarina glauca (Casuarina) were used to examine the behaviour of each type on the exhaust oil retention percentage and then the influence of exhaust oil retained by the wood on its ability to absorb water percentage. To achieve this 24 wood specimens of each type were prepared. The size of each specimen was 2.5 x 2.5 x 10 cm according to the regulation of the American Society for Testing and Materials. Physical and mechanical properties for eucalypt and casuarina wood are shown in Table (1) **(Kandeel and Badran, 1974).**

3.1.2. Exhaust Oil :

Engine exhaust oil (Super 7500) was used for treating the specimens of wood for a period of one to seven weeks. Specifications of oil and exhaust oil (super 7500) are shown in Table (2).

Table (1): Physical and mechanical properties for eucalypt and casuarina wood.
(Kandeel and Badran, 1974)

Wood species	*T.N.	*S.N.	*M.C.	*C.T.P	*M.C.	*S.B.T.		*M.C.	*C.T.	*T.P.	*H.T.		*M.C.	*I.T.	*M.C.	*S.G.
						*M.O.E	*M.O.R				*R.G.	*T.G.				
			(%)	(KN)	(%)	(kN/cm^2)	(kN/cm2)	(%)	(kN)	(kN)	(kN)	(kN)	(%)	(kN/m)	(%)	
Eucalypt	4	72	12.49	16.80	12.49	837.55	8.2228	12.49	0.612	1.205	5.422	5.514	12.49	0.024	12.49	0.694
Casuarina	2	120	14.04	19.41	12.87	1825.5	11.844	13.16	0.754	1.846	7.660	7.844	12.01	0.062	12.43	0.846

*** T.N** .... **Tree nmuber**
*** M.C** .... **Moisure content (%)**
*** S.B.T.** .... **Static bending test (kN/cm^2)**
*** M.O.R.** .... **Modulus of ruputre (kN/cm^2)**
*** T.P.** .... **Tension perpendicular to grain (kN)**
*** R.G.** .... **Radial grain (kN)**
*** I.T.** .... **Impact test (kN/m)**
*** S.N.** .... **Specimens number**
*** C.T.P.** .... **Compression test parallel to grain (kN)**
*** M.O.E.** .... **Modulus of elasticity (kN/cm^2)**
*** C.T.** .... **Cleavage test (kN)**
*** H.T.** .... **Hardness test (Janka test) (kN)**
*** T.G.** .... **Tangential grain (kN)**
*** S.G.** .... **Specific gravity**

Table (2): Specification of oil and exhaust oil super (7500)
(Bahtiem Reclamation plant)

Characteristics	No. of standard method	Units	Oil	Exhaust oil
Colour	ASTM D 1500	--	6	over 8
Density at 15/4°C	I.P.160	kg/dm^3	0.9057	0.954
Flash point opened	ASTM D 92	°C	234	375
Flash point closed	I.P. 34	°C	208	275
Viscosity at 40°C	I.P. 71		171.88	151.35
Viscosity at 100°C	ASTM D 445	C.st	16.06	16.54
Viscosity index	ASTM D 2270	--	96	99-125
Pour point	I.P. 15	°C	-6	-35- -15
Ash content	ASTM D 482	g/100 g	1.077	0.5-1.2
Total acid No.	ASTM D 664	mg.KOH/g	2.7	1.4
Carbon conradson	ASTM D 189	% wt.	1.41	0.29
Pentane insoluble	ASTM D 893	% wt.	--	1.3-1.9
Benzene insoluble	ASTM D 893	% wt.	--	0.5-0.89
Water percent	ASTM D 95	% wt.	--	0.2
Metals p.p.m.	Atomic	p.p.m.		
Zinc	Absorption		0.108	9
Copper	Spectroscopy		--	40-15
Iron	Spectroscopy		--	60-18
Calcium	Spectroscopy		0.156	10-100

3.1.3. Trays :

Wooden trays were made from eucalypt wood of one cm., thickness and with same dimensions like the plastic tray, i.e., 60 x 30 x 3 cm. Two shapes of the wooden trays bottom were made.

The first shape is formed from 15 wooden strips of 3 cm wide, one cm. apart from each other. The second shape is made of 6 adjacent strips of 10 cm. wide and perforated with 9 x 18 holes of one cm. diameter.

The weight of the plastic and the wooden trays are 0.6 kg and 1.7 kg, respectively. The plastic and the wooden trays are shown in Fig. (1).

3.1.4. Transplanter :

4- row walking type transplanter was used with following specifications as shown in Table (3) and Fig. (2).

Table (3): Specifications of 4- row walking type transplanter.

Specifications	4- row walking type
Model	Yanmar YP 400
Type	Walking, 4 row type
Max. out- put power	2.57 kw.
Overall length	240 cm.
Overall width	153 cm.
Overall height	95 cm.
Net weight	160 kg.
Planting row	4
Planting speed	0.5 m/ s
Number of hills/ 3.3 m^2	60- 70- 80 - 90
Row spacing	300 mm.
Speed change	1 forward and 1 reverse speeds
Planting system	Rotary system
Spacing between hills	18 - 16 - 14 - 12 cm.
Seedling mat	58 x 28 x 3 cm.
Seedling height	8- 25 cm.
Fuel tank capacity	3.5 L.

(MANUAL OF RICE TRANSPLANTER NO. 2 R.M.C. 1986).

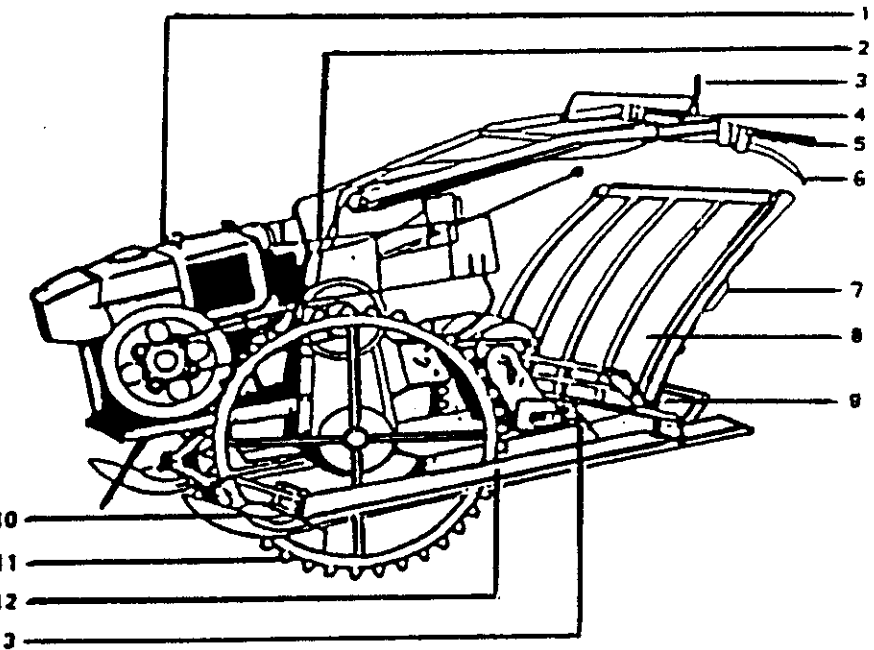

Fig. (2) :Walking type 4 - row rice transplanter

(MANUAL OF RICE TRANSPLANTER NO. 2 R.M.C. 1986)

1- Engine
2- Shelves of reserve sedling
3- Brake
4- Main clutch
5- Handle bar
6- Side clutch
7- Transplanting clutch
8- Seedling bord
9- Transplanting arm
10- Guider
11- Traction wheel
12- Float
13- Fork

3.2. METHODS :

3.2.1. Wood Preservation :

Preservation (oil) penetrations and retention obtained through dipping are usually lower than those obtained by cold soak and steeping. (Wood Hardbook, 1974). Thus this process was followed by the investigator to evaluate the effect of the engine exhaust oil as a preservative for wooden trays for rice nursery. Treatment of the wood with oil was achieved through cold soaking and steeping process (Wood Hardbook, 1974).

Wooden specimens were dried at 105^0C in an oven for 24 hours. For the two selected wood species , 8 treatments of 3 specimens each were prepared , 7 treatments were soaked in the engine exhaust oil for 7 different periods of one to seven weeks. The 8 th treatment was used as control, i.e. soaking time in the oil is zero. By the end of each period, wooden specimens were left to dry for one day and then soaked in water for 21 days. Oil retention percentage and water absorbed percentage by the wooden specimens were recorded for oil each one week and for water every 3 day.

The measurements taken for wooden specimens were as follows :

a) Moisture content determination :

Moisture content of the wood specimens were determined according to the oven drying method **(Kandeel and Abouhosen, 1993)** Across section is cut from each board and then completely dried in a heated oven. The section remains in the oven for at least 12 hours and sometimes longer. The method consists of the five steps:

(1) Cut across section about 2.5cm.thick, along the grain , from a board, usually some distance from the end,

(2) Immediately after sawing, remove all loose splinters and weight the section . (Iw)

(3) Put the section in an oven maintained at $103^0C \pm 2^0C$ ($217.4^0 \pm 3.6^0F$) and dry until a constant weight.

(4) Weight the dry section to obtain the oven dry weight. (ODw)

(5) Subtract the oven dry weight from the initial weight, multiplying the result by 100 to obtain the percentage moisture in the section.

$$MC = \frac{I_w - OD_w}{OD_w} \times 100$$

where :

Mc : Moisture content percentage (%)

I_w : The initial weight (g)

OD_w : The oven dry weight (g)

b) Absorbed water determination without oil (control treatment):

$$A.W. = \frac{WASW - ODw}{ODw} \times 100$$

where :

A.W. : Absorbed water percentage (%) for 3 to 21 days.

WASW : The weight after soaking in water of wood specimen for 3 to 21 days (g)

OD_w : The oven dry weight of wood specimen (g).

c) Oil retention determination :

$$O.R. = \frac{WASO - OD_w}{ODw} \times 100$$

where :

O.R. : Oil retention percentage (%) for one to seven weeks.

WASO : The weight after soaking in oil of wood specimen for one to seven weeks (g).

OD_w : The oven dry weight of wood specimen (g).

d) Absorbed water determination after treatment with oil :

$$A.W. = \frac{WASW - WASO}{WASO} \times 100$$

where :

A.W. : Absorbed water percentage (%) for 3 to 21 days

WASW : The weight after soaking in water of wood specimen for 3 to 21 day (g).

WASO : The weight after soaking in oil of wood specimen for one to seven weeks (g).

3.2.2. Seeds Preparation :

Seeds were put into a salty solution of 1.13% to get rid of undesired seeds by flotation on the surface. The rest of seeds was washed in abenlate. - T (5 ml per 2 liters water) to cure the seeds for fungicides. Thus the disinfected seed was packed in jute sacks to soaking and pregermination for 3 days to encourage sprouting to a length of 1 - 2 mm.

3.2.3. Transplanting Trays Preparation :

The sieved soil was placed on a sheet of news paper located into the tray to prevent soil to be lost, and was leveled by leveling plate to measure thickness of seedbed of about 1.5 cm. thickness. 200 grams of germinated seeds (Giza 177), were sown uniformity on the tray. The trays were covered to be protected form light and incubated from 24 to 48 hours for helping the seeds to grow faster. Then, transferd to the nurseries and irrigated two times a day.

3.2.4. Nursery Preparation :

The nursery area was selected to be near for irrigation source. The soil was chiseled two passes for a depth of 20 cm. and perfectly levelled and divided into wide plots each plot (2 x 12 m) to be ready to locate the trays easily as show in Fig, (3).

3.2.5. Experimental Design for Nursery :

An experiment was designed in a randomized completely block design (RCBD), to study the influence of the oil treatment and the bottom shape for the wooden trays on the seedlings characteristics. The nursery area was divided into three replecote

The following measurements for seedlings characteristics were taken **(El-Zemeity, 1988)**

a) Seedlings height (cm):

Seedlings height were measured randomly for 10 samples of seedlings in different locations in each tray weekly for a period of 3 weeks.

b) Root length (cm.) & Number of leaves/ seedling :

From each tray 10 seedlings were selected at random to measure the root length and number of leaves/ seedlings after 3 weeks from sowing.

c) Seedlings dry weight (mg.):

Seedlings dry weight was estimated by drying 20 seedlings for each tray at 105^{0}C in an oven for 24 hours.

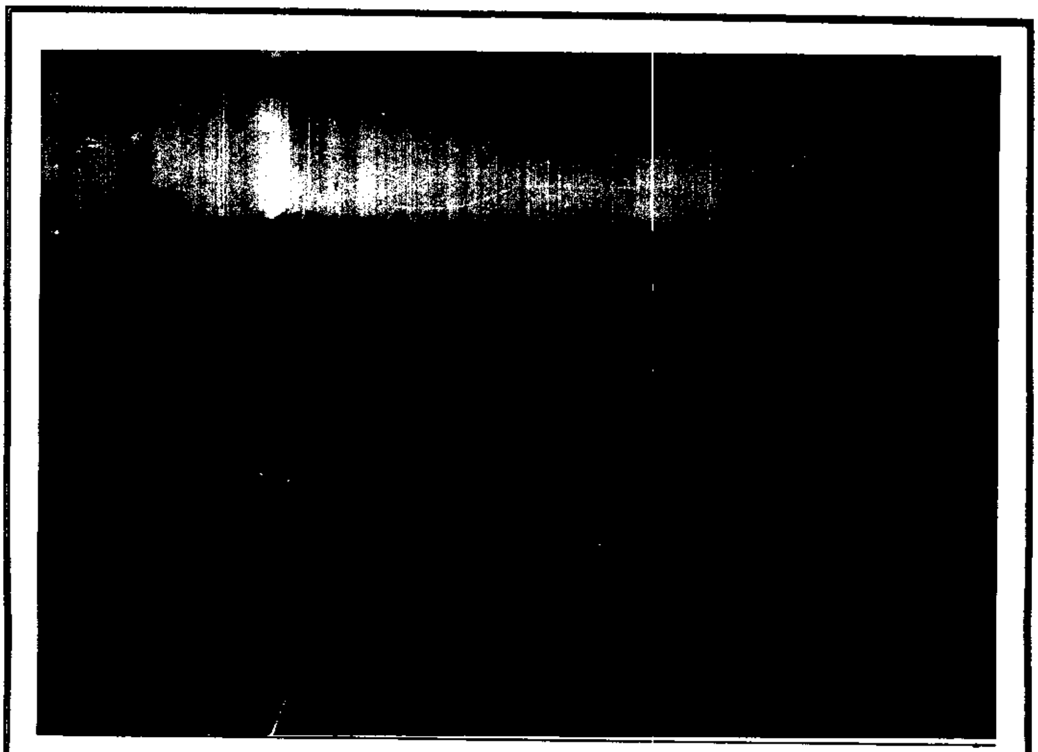

Fig. (3) : Nursery preparation .

d) Seedlings density/ cm2 :

Seedlings density was counted by taken 3 samples of size 1 cm^2 for each tray.

3.2.6. Experimental Design for Field :

The field experiment was carried out to study the influence of the bottom shape for the wooden trays on the performance of the transplanter i.e., missed and sloped hills %, and then to study the influence of the oil treatment for the wooden trays on the grain and straw yield (t/ fed.) in comparison with plastic trays. The field area was chiseled for a depth of 15 cm and divided into three equal replicates and then each replicate was divided into three plots, to be planted with three different trays.

The area of each plot was arranged in a randomized complete block design (RCBD) Fig. 4).

The field measurements were estimated as follows :

a) The missed hills percentage :

Missed hills percentage was calculated by using the following formula **(El-Hossary *et al.*, 1980):**

$$M_h = \frac{N_m}{N_{th}} \times 100$$

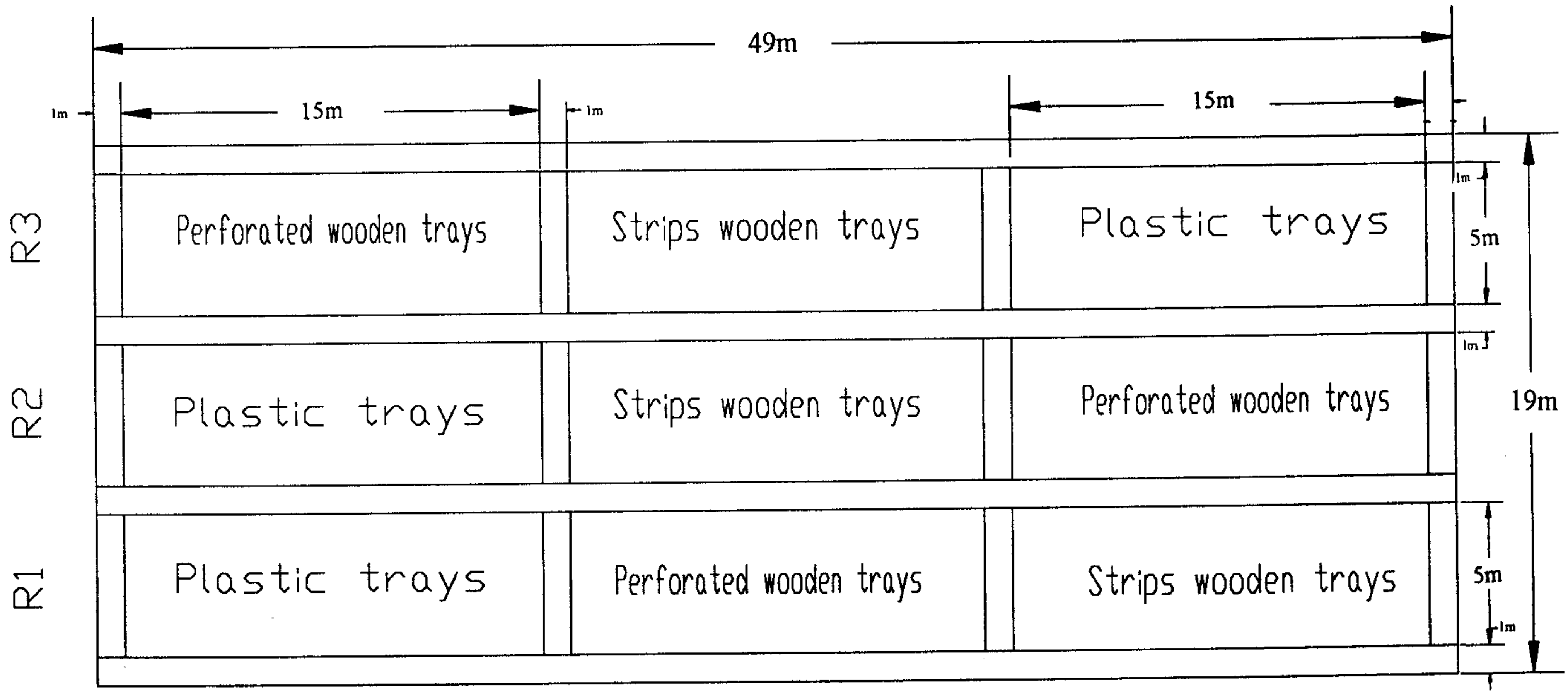

Fig. (4) : The experimental design of field

where :

M_h = Missing hills percentage (%).

N_m = Number of the missed hills/ m^2

N_{th} = Number of the theoretical hills/ m^2.

b) The sloped hills percentage :

Sloped hills percentage was calculated by using the following formula **(El-Hossary *et al.*, 1980):**

$$S_h = \frac{N_s}{N_{th}} \times 100$$

where :

S_h = Sloped hills percentage (%) .

N_s = Number of the sloped hills/ m^2.

N_{th} = Number of the theoretical hills/ m^2.

c) Grain and straw yield (ton/ fed.) :

Estimated by harvesting one meter square and weighting the produced grain and straw yield.

4- RESULTS AND DISCUSSION

The results are presented through the following four parts:

4.1. Finding alternative trays to plastic trays for rice nursery .
4.2. Nursery experiment.
4.3. Field experiment.
4.4. Economical view.

4.1.Finding alternative trays to plastic trays for rice nursery:

4.1.1. Influence of the water soaking periods on the absorbed water percentage (%), for the two selected wood species :

Data in Table (4) and Fig. (5) show the absorbed water percentage, by the wood specimens for the two selected wood species, eucalypt and casuarina. Wood specimens were soaked in water for the period of 3 to 21 days and measurements were recorded every 3 days. Each reading is an average of three readings for the two wood species. Raw data are presented in appendix (1). For eucalypt wood the absorbed water percentage were 32, 43.9, 52.4, 59.7, 64.8, 69.3 and 73.8 % for the seven water soaking periods of 3 to 21 days, respectively and for casuarina wood were 46.2, 58.5, 70.3, 80.5, 88.2, 94.3 and 99.9 %, respectively for same water soaking periods.

The obtained results indicate that, the ecualypt wood absorbed less water percentage than casuarina by 14.2, 14.6, 17.9, 20.8, 23.4, 25

Table (4) : Influence of the water soaking periods on the absorbed water percentage (%), for the two selected wood species.

Wood species	Soaking periods in water						
	* A.W. (%) 3 Days	* A.W. (%) 6 Days	* A.W. (%) 9 Days	* A.W. (%) 12Days	* A.W. (%) 15 Days	* A.W. (%) 18Days	*A.W. (%) 21 Days
Eucalypt	32	43.9	52.4	59.7	64.8	69.3	73.8
Casuarina	46.2	58.5	70.3	80.5	88.2	94.3	99.9

* A.W.(%)..Absorbed water percentage(%), for the water soaking periods of 3 to 21 days with 3 days intreval.

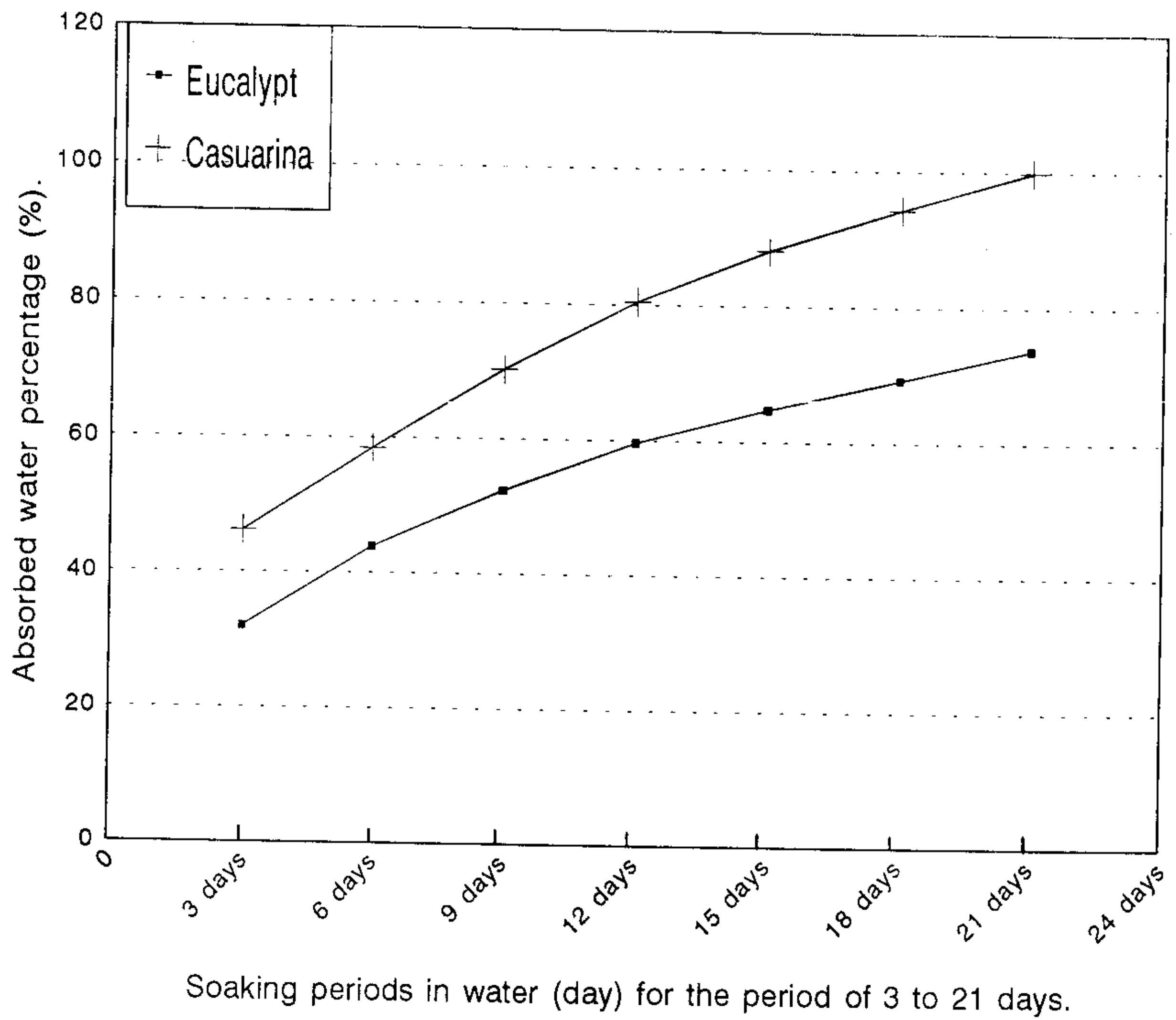

Fig. (5): Influence of water soaking periods on the absorbed water percentage (%).for the two selected wood species.

and 26.1 % for the period of 3 to 21 days, respectively. Therefore the eucalypt wood is better than casurina wood for making rice nursery trays.

4.1.2. Influence of the oil soaking periods on the oil retention percentage (%), for the two selected wood species :

Data reported in Table (5) and Fig. (6) reveal the oil retention percentage by wood specimens, for the two selected wood species eucalypt and casuarina . Wood specimens were soaked in oil for the period of one to seven weeks and measurements were recorded every one week . Raw data are presented of appendix (2) to (8).

For eucalypt the oil retention percentages were 9.4, 13.2, 20.3, 22.5, 23.3, 23.3 and 23.3 % for the seven oil soaking periods of one to seven weeks, respectively and for casuarina wood were 12.3, 17.6, 23.4, 26.9, 29.3, 30.1 and 30.1 %, respectively for same oil soaking periods.

It is obvious that the oil retention percentage was increased gradually from one to five weeks for eucalypt , and from one to six weeks for casuarina wood and it became constant for the remaining periods.

These results show that casuarina retained more oil percentage than eucalypt wood by 2.9, 4.4, 3.1, 4.4, 6, 6.8 and 6.8 % for the period of one to seven weeks, respectively.

Table (5): Influence of the oil soaking periods on the oil retention percentage (%), for the two selected wood species.

Wood species	Soaking periods in exhaust oil.						
	* O.R. (%) 1 Week	* O.R. (%) 2 Week	* O.R. (%) 3 Week	* O.R. (%) 4 Week	* O.R. (%) 5 Week	* O.R. (%) 6 Week	* O.R. (%) 7 Week
Eucalypt	9.4	13.2	20.3	22.5	23.3	23.3	23.3
Casuarina	12.3	17.6	23.4	26.9	29.3	30.1	30.1

* O.R.(%). Oil retention percentage(%), for the Oil soaking periods of One to seven weeks with one week intreval.

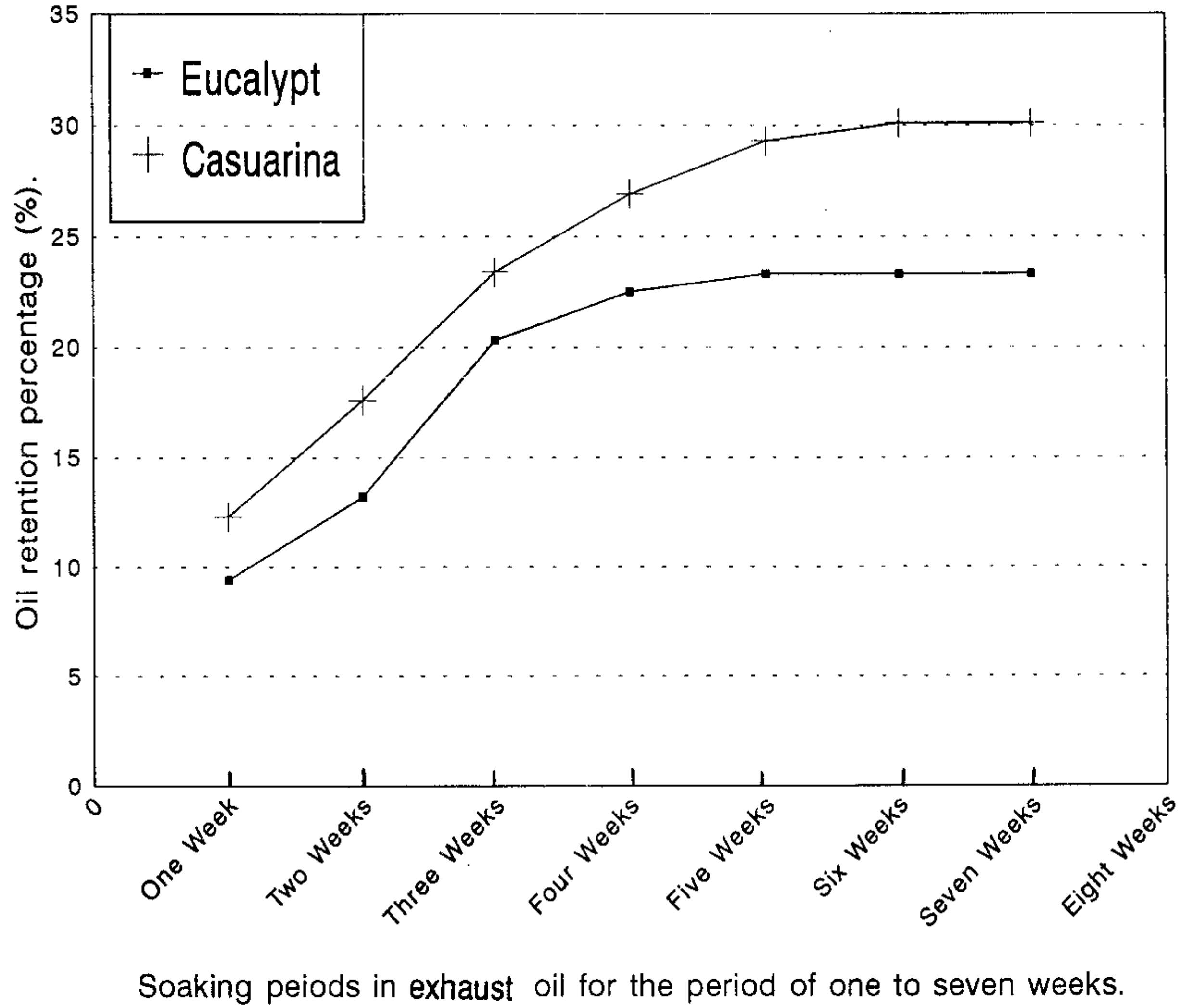

Fig. (6): Influence of the oil soaking periods on the oil retention percentage (%), for the two selected wood species.

The lower oil retention percentages showed by eucalypt may be due to its higher extractives content reaching 30 % in the heart wood. **(Hillis and Brown, 1978) (Kheralla, 1975).** However, in younger eucalypt this ratio reaches 15.3 % **(Moharab, 1997).**

On the contrary casuarina , due to its relatively lower extractives content (3.7 % in the heart wood of young trees and 7.6 % in older stock) showed higher retention percentage **(Kandeel *et al.*, 1993** and **Moharab 1997).**

4.1.3. Influence of the oil soaking periods on the absorbed water percentage (%) :

The represented data in Tables (6), (7) and Fig. (7), (8) show the influence of each oil soaking period on the absorbed water percentage after the water soaking period for eucalypt and casuarina, respectively. Eight treatments of 3 specimens each were used for the two selected wood species , 7 treatments were soaked in the oil for the seven different periods of one to seven weeks and measurements were recorded every one week. The 8 th treatment was used as control i.e., without oil treatment . Each specimen with and without oil soaking were soaked in water for a period of 3 to 21 days and measurements were recorded every 3 days. Raw data are presented of appendix (1) to (8).

Table (6) : Influence of each oil soaking periods for eucalypt wood on the absorbed water percentage (%), after the water soaking periods .

Treatments		* O.R.(%)	Soaking periods in water						
			* A.W. (%) 3 Days	* A.W. (%) 6 Days	* A.W. (%) 9 Days	* A.W. (%) 12Days	* A.W. (%) 15 Days	* A.W. (%) 18 Days	*A.W. (%) 21 Days
Soaking periods in exhaust oil	One week	9.4	16	24.2	32.5	37.6	40.7	42.8	44.8
	Two weeks	13.2	13.4	20.4	27.9	33.3	36.3	38.3	40.3
	Three weeks	20.3	8.3	14.4	19.4	23.1	25	26.9	28.7
	Four weeks	22.5	6.3	10.9	14.9	17.7	19.9	21.7	23.5
	Five weeks	23.3	5.8	9.9	13	15.7	17.5	19.3	20.6
	Six weeks	23.3	5.8	9.8	13	15.6	17	18.3	19.2
	Siven weeks	23.3	5.7	9.7	13.1	15.7	17.1	18.4	19.3
Control treatment		-	32	43.9	52.4	59.7	64.8	69.3	73.8

*A.W.(%)..Absorbed water percentage(%), for the water soaking periods of(3-21)days with (3)days intreval.
*O.R.(%)..Oil retention percentage(%), for the Oil soaking periods of (1-7) weeks with (1) week intreval.

Table (7) : Influence of each oil soaking periods for Casuarina wood on the absorbed water percentage (%), after the water soaking periods .

Treatments		* O.R.(%)	Soaking periods in water						
			* A.W. (%) 3 Days	* A.W. (%) 6 Days	* A.W. (%) 9 Days	* A.W. (%) 12Days	* A.W. (%) 15 Days	* A.W. (%) 18 Days	*A.W. (%) 21 Days
Soaking periods in exhaust oil	One week	12.3	36.1	45.7	55.2	62.1	67.6	71.7	75.8
	Two weeks	17.6	32.6	41.7	49.6	56.1	61.3	65.2	69.1
	Three weeks	23.4	28.5	37.2	44.6	50.8	55.8	59.9	64
	Four weeks	26.9	25.6	34	41.2	46.4	51.2	55.2	59.2
	Five weeks	29.3	23.5	30.6	36.1	41.2	45.9	49.8	53.3
	Six weeks	30.1	23.2	29	34.7	39.8	44	47.9	51.4
	Siven weeks	30.1	23.2	29	34.4	39.3	42.9	46.3	48.7
Control treatment		-	46.2	58.5	70.3	80.5	88.2	94.3	99.9

*A.W.(%)..Absorbed water percentage(%), for the water soaking periods of(3-21)days with (3)days intreval.
*O.R.(%)..Oil retention percentage(%), for the Oil soaking periods of (1-7) weeks with (1) week intreval.

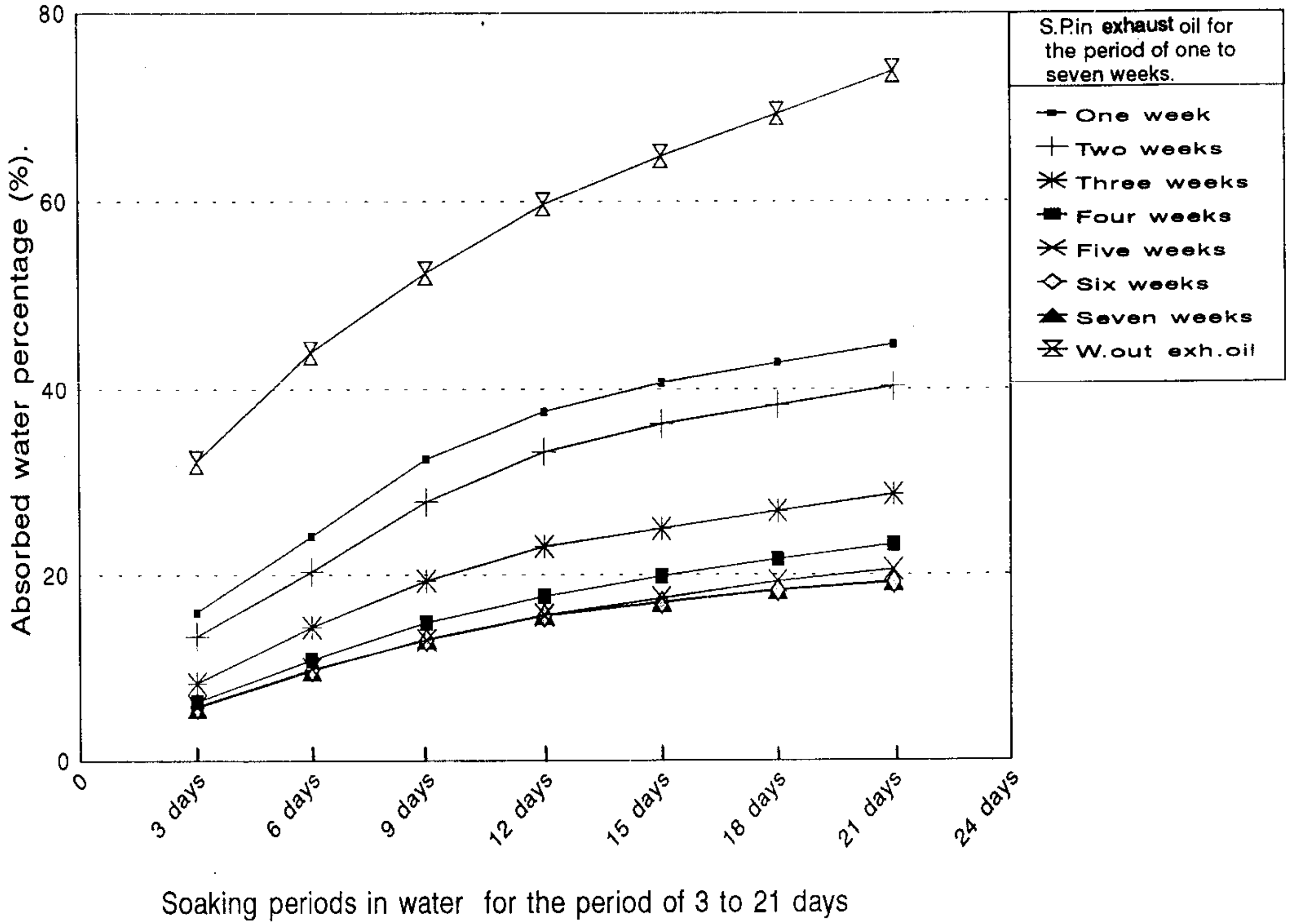

Fig. (7): Influence of each oil soaking period for eucalypt wood on the absorbed water percentage (%),after the water soaking periods.

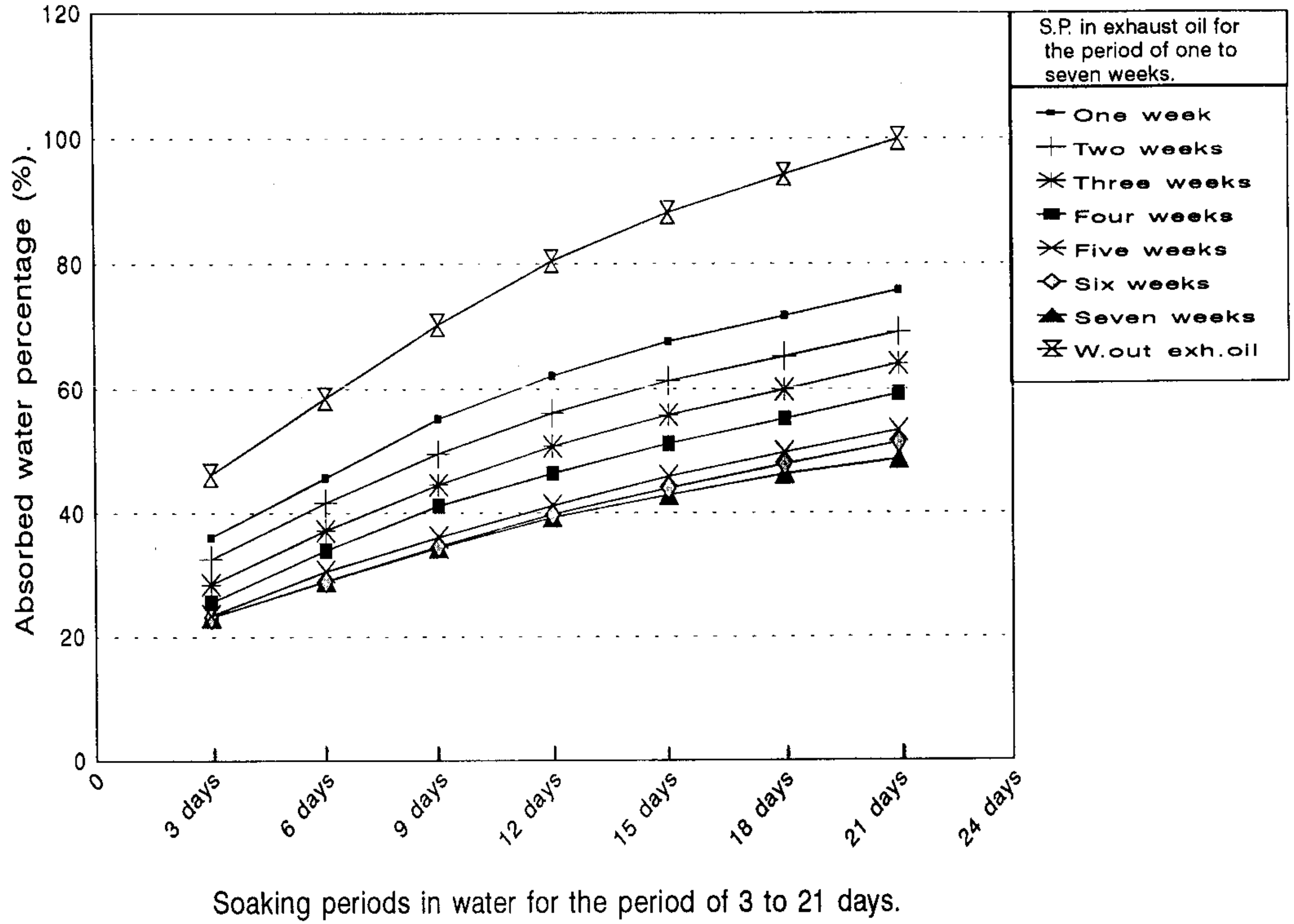

Fig. (8): Influence of each oil soaking period for casuarina wood on the absorbed water percentage (%), after the water soaking periods.

For control treatment the absorbed water percentage for eucalypt were 32, 43.9, 52.4, 59.7, 64.8, 69.3 and 73.8 % for the seven water soaking periods of 3 to 21 days, respectively and for casuarina, were 46.2, 58.5, 70.3, 80.5, 88.2, 94.3, and 99.9 % , respectively for same water soaking periods.

A comparison between the data which recorded for the wood specimens with and without oil treatment, it was found that the absorbed water percentage for the seven water soaking periods of 3 to 21 days was decreased according to each oil soaking period as follows:

a) <u>For the one week oil soaking period</u>.

For eucalypt the absorbed water percentage was reduced for the seven water soaking periods of 3 to 21 days by 16, 19.7, 19.9, 22.1, 24.1, 26.5 and 29 %, respectively and for casuarina by 10.1, 12.8, 15.1, 18.4, 20.6, 22.6 and 24.1 %, respectively.

b) <u>For the two weeks oil soaking period.</u>

For eucalypt the absorbed water percentage was reduced for the seven water soaking periods of 3 to 21 days by 18.6, 23.5, 24.5, 26.4, 28.5, 31 and 33.5 %, respectively and for casurina by 13.6, 16.8, 20.7, 24.4, 26.9, 29.1, and 30.8 %, respectively.

c) <u>For the three weeks oil soaking period.</u>

For eucalypt the absorbed water percentage was reduced for the seven water soaking periods of 3 to 21 days by 23.7, 29.5, 33, 36.6, 39.8, 42.4 and 45.1, respectively and for casuarina by 17.7, 21.3, 25.7, 29.7, 32.4, 34.4, and 35.9 %, respectively.

d) For the four weeks oil soaking period.

For eucalypt the absorbed water percentage was reduced for the seven water soaking periods of 3 to 21 days by 25.7, 33, 37.5, 42, 44.9, 47.6 and 50.3 %, respectively and for casuarina by 20.6, 24.5, 29.1, 34.1, 37, 39.1, and 40.7 %, respectively.

e) For the five weeks oil soaking periods.

For eucalypt the absorbed water percentage was reduced for the seven water soaking periods of 3 to 21 days by 26.2, 34, 39.4, 44, 47.3, 50 and 53.2 %, respectively and for casuarina by 22.7, 27.9, 34.2, 39.3, 42.3, 44.5 and 46.6 %, respectively.

f) For the six weeks oil soaking period.

For eucalypt the absorbed water percentage was reduced for the seven water soaking periods of 3 to 21 days by 26.2, 34.1, 39.4, 44.1, 47.8, 51 and 54.6 %, respectively and for casuarina by 23, 29.5, 35.6, 40.7, 44.2, 46.4 and 48.5 %, respectively.

g) For the seven weeks oil soaking period.

For eucalypt the absorbed water percentage was reduced for the seven water soaking periods of 3 to 21 days by 26.3, 34.2, 39.3, 44, 47.7, 50.9 and 54.5 %, respectively and for casuarina by 23, 29.5, 35.9, 41.2, 45.3, 48 and 51.2 %, respectively.

It seem from results for eucalypt that, after the five weeks oil soaking period, apart of oil was loosen in water so that the absorbed water percentage was increaed by 0.5, 1, and 1.4 % at water soaking periods of 15, 18 and 21 days, respectively. and forcasuarina after the six weeks oil soaking period, a part of oil was loosen in water, so that the absorbed water percentage was increased by 0.3, 0.5, 1.1, 1.6 and 2.7% at water soaking periods of 9,12,15,18,21 days, respectively. These results indicate for eucalypt and casuarina that the absorbed water percentage decreased with increasing the oil retention percentage and it is summarized that for eucalypt the six weeks is the best oil soaking period and for casuarina the optimam oil soaking periods is seven weeks.

The recorded results in Table (8) and Fig (9) show the influence of the oil soaking periods on the absorbed water percentage for the two selected wood species after 21 days of the water soaking period. It is obvious from these results that eucalypt absorbed less water percentage than casuarina after 21 days of the water soaking period at the seven oil soaking periods by 31, 28.8, 35.3, 35.7, 32.7, 32.2 and 29.4 %, respectively. Although casuarina retained more oil percentage than eucalypt, but eucalypt absorbed less water percentage. Generally, it is recommended to use eucalypt wood as alternative system to plastic trays with six weeks of the oil soaking period.

4.2. Nursery experiment :

4.2.1 Influence of the oil treatment and the bottom shape for the wooden trays on the seedlings height (cm).

The represented data in Table (9) and Fig. (10)show the average height of rice seedlings. The seedlings heights were measured

Table (8): Influence of the oil soaking periods for the two selected wood species on the absorbed water percentage (%), after (21) days water soaking periods.

Wood species	Soaking periods in exhaust oil							
	Treatment	One week	Two weeks	three weeks	Four weeks	Five weeks	Six weeks	Siven weeks
Eucalypt	* O.R. (%)	9.4	13.2	20.3	22.5	23.3	23.3	23.3
	* A.W. (%)	44.8	40.3	28.7	23.5	20.6	19.3	19.3
Casuarina	* O.R. (%)	12.3	17.6	23.4	26.9	29.3	30.1	30.1
	* A.W. (%)	75.8	69.1	64	59.2	53.3	51.4	48.7

*A.W.(%)..Absorbed water percentage(%), for the water soaking periods of(3-21)days with (3)days intreval.

*O.R.(%)..Absorbed oil percentage(%), for the Oil soaking periods of (1-7) weeks with (1) week intreval.

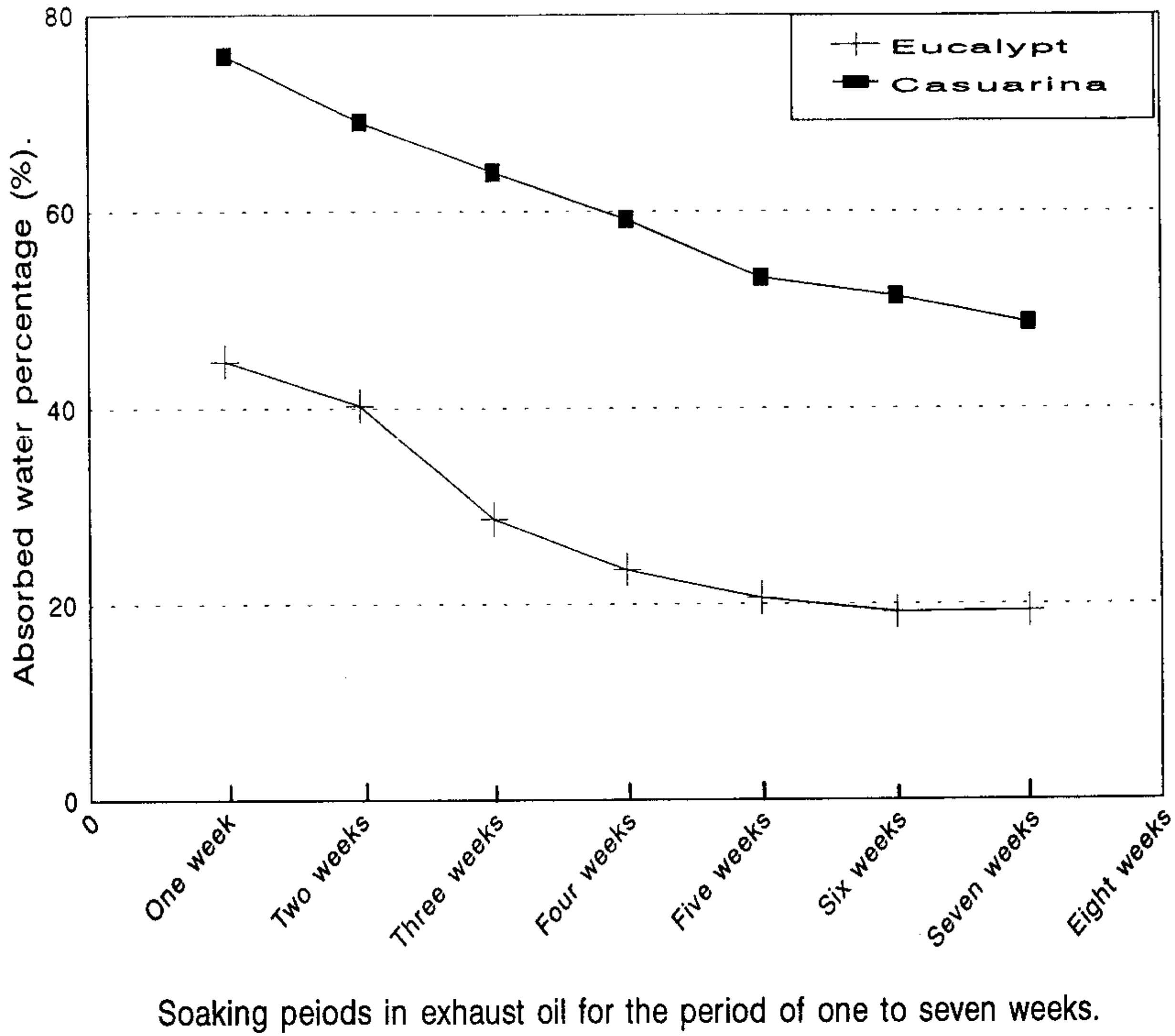

Fig. (9) Influence of the oil soaking periods for the two selected wood species on the absorbated water percentage (%), after (21) days water soaking period.

Table (9): Influence of the oil treatment and the bottom shape for the wooden trays on the seedlings height (cm.)

Kind of trays	Seedlings height (cm.)											
	One week after sowing			Average	Two weeks after sowing			Average	Three weeks after sowing			Average
	R1	R2	R3		R1	R2	R3		R1	R2	R3	
1-Plastic	4.37	4.25	4.37	4.33	8.13	8.57	8.38	**8.36**	13.01	13.11	13.25	**13.12**
2-Perforated wooden	4.44	4.41	4.32	4.42	8.25	8.15	8.62	**8.34**	13.08	13.04	13.43	**13.18**
3-Strips wooden	4.43	4.37	4.36	4.39	8.6	8.10	8.25	**8.32**	13.1	13.18	13.04	**13.11**
F-test				N.S.				N.S				N.S.

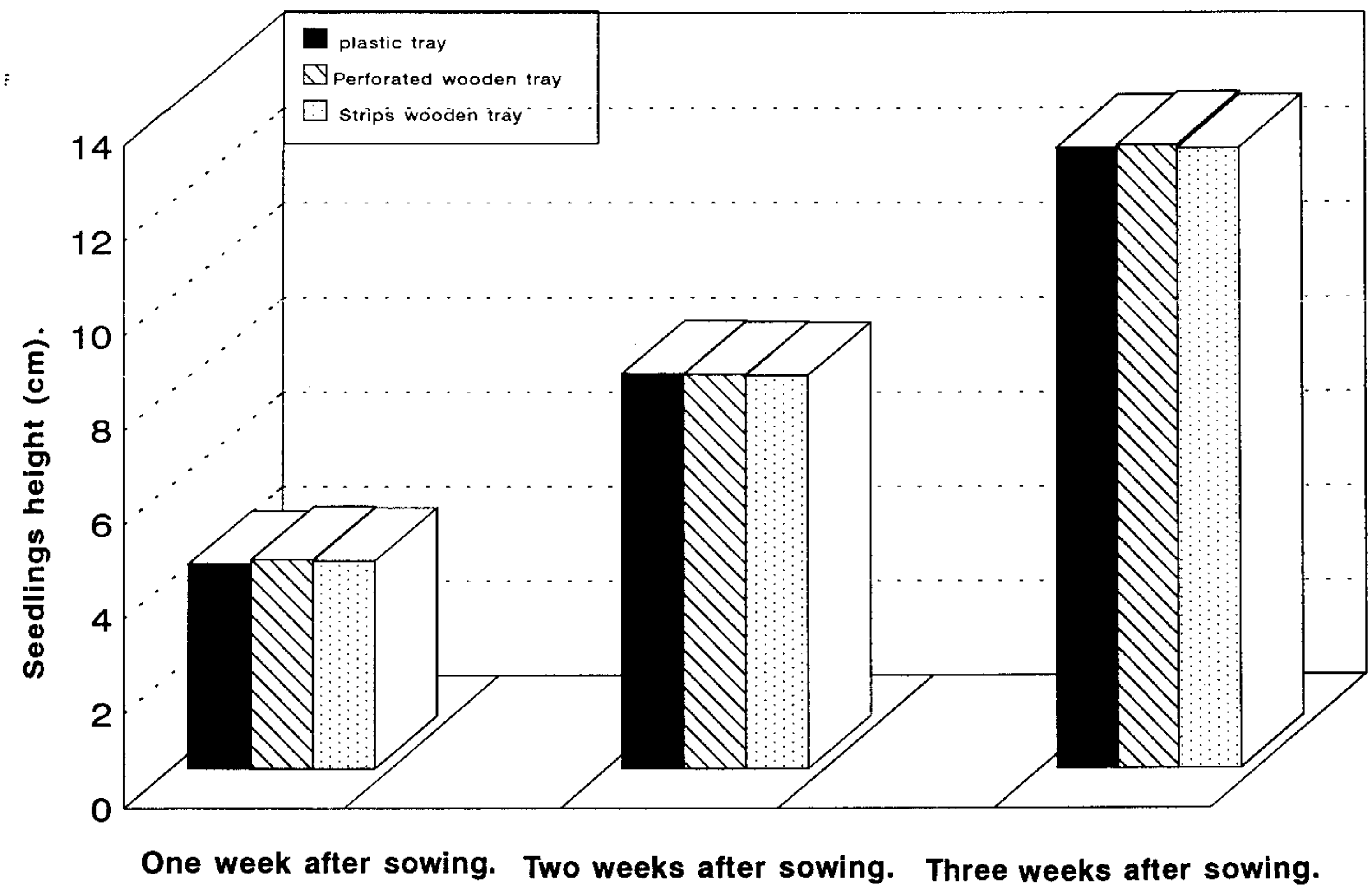

Fig. (10): Influence of the oil treatment and the bottom shape for the wooden trays on the seedlings height (cm.)

randomly for 10 samples of seedlings in different locations in each tray weekly for a period of 3 weeks.

For the plastic trays, perforated wooden trays and strips wooden trays, the seedlings heights were 4.33, 4.42 and 4.39 cm. for the first week, 8.36, 8.34 and 8.32 cm. for the second week and were 13.12, 13.18 and 13.11 cm. for the third week respectively.

The statistical analysis in Table (9) show clearly that there is no significant difference between the three used trays for all measuring periods for the seedlings height (cm).

4.2.2. Influence of the oil treatment and the bottom shape for the wooden trays on the root length (cm).

Data reported in Table (10) and Fig. (11) show the average root length after three weeks form sowing. From each tray 10 seedlings were selected at random to measure the average root length. For the plastic trays, perforated wooden trays, and strips wooden trays the root length were 5.08, 5.09 and 5.0 7 cm respectively. It seems from Table (10) that the influence of the oil treatment and the bottom shape for the wooden trays is not significant for the root length.

4.2.3. Influence of the oil treatment and the bottom shape for the wooden trays on the number of leaves / seedling.

The number of leaves/ seedling counted by 10 seedlings from each tray randomly after three weeks. It is obvious from Fig. (12) that

Table (10): Influence of the oil treatment and the bottom shape for the wooden trays on the
-Root length (cm.)
-Number of leaves per seedling
-Dry weight of seedlings (mg.)
-seedlings density (seedlings/cm^2)

Kind of trays	Root length (cm.)			Average	Number of leaves per seedling			Average	Dry weight of seedling(mg.)			Average	Seedlings desity (seedling/cm^2)			Average
	R1	R2	R3		R1	R2	R3		R1	R2	R3		R1	R2	R3	
1-Plastic	5.03	5.1	5.11	5.08	2.3	2.5	2.3	2.4	24	21	22	22.3	7.3	7.7	7	7.3
2-Perforated wooden	5.11	5.13	5.09	5.09	2.2	2.5	2.2	2.3	24	23	24	23.3	7.7	6.7	7	7.1
3-Strips wooden	5.06	5.03	5.14	5.07	2.3	2.3	2.4	2.3	24	24	22	23.7	7.3	7.7	6.7	7.2
F-test				N.S				N.S				N.S				N.S

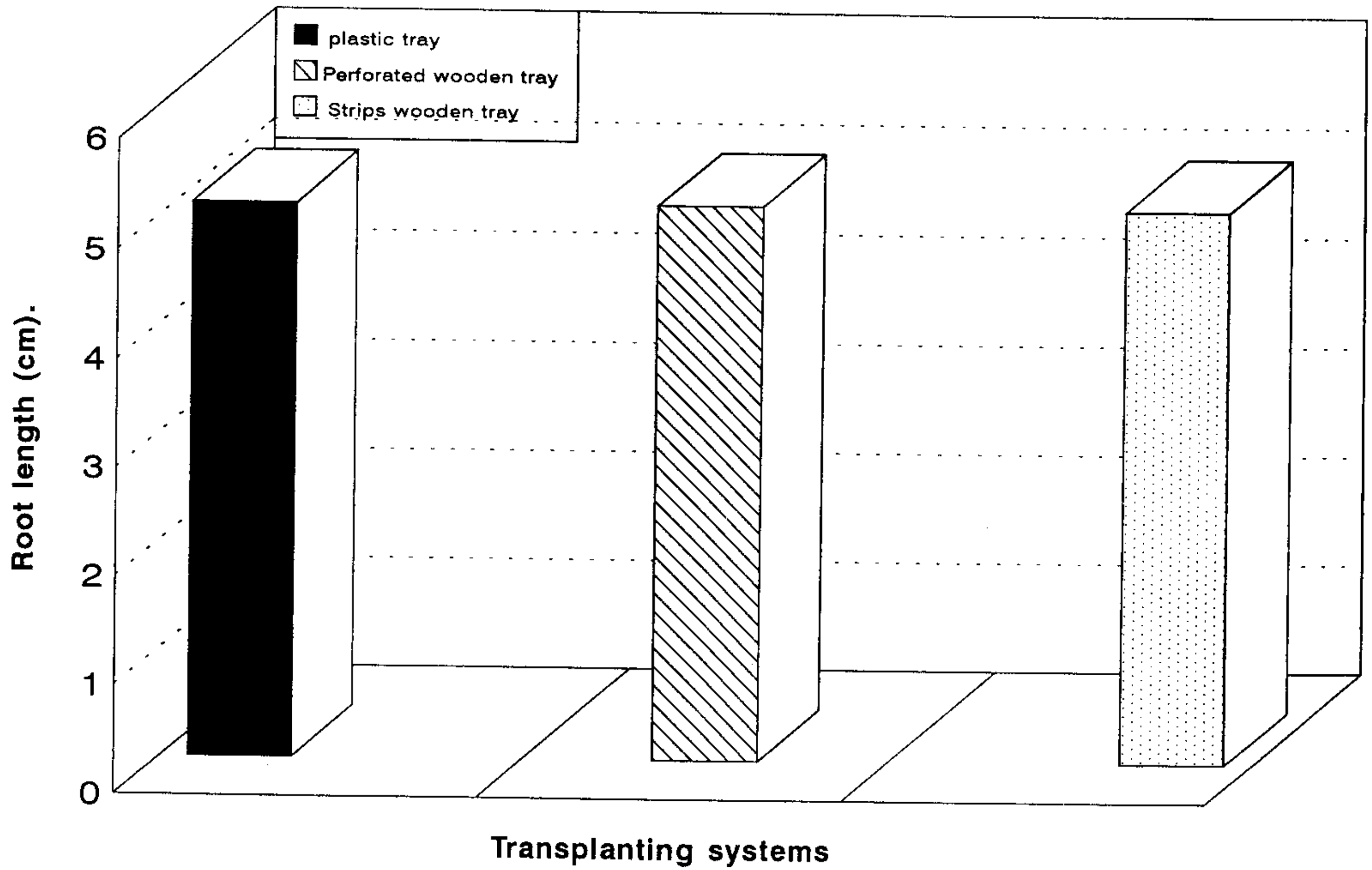

Fig. (11): Influence of the oil treatment and the bottom shape for the wooden trays on the root length (cm.)

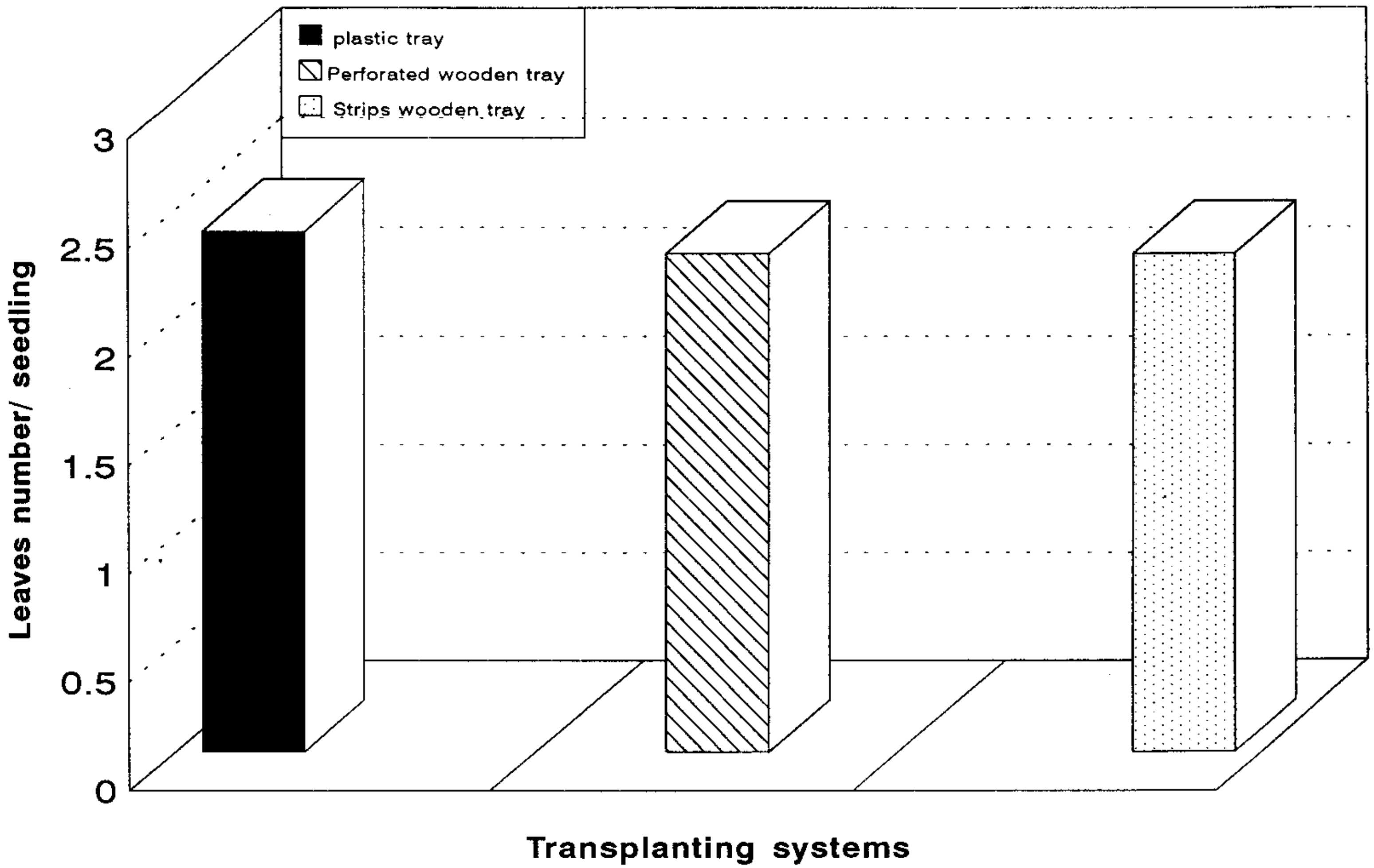

Fig. (12): Influence of the oil treatment and the bottom shape for the wooden trays on the number of leaves per seedling

the number of leaves were 2.4, 2.3, 2.3 leaves/ seedling were recorded by the plastic trays, perforated wooden trays and strips wooden trays, respectively.

The statistical analysis in Table (10) show that the effect of the oil and bottom shape is not significant for all used trays.

4.2.4. Influence of the oil treatment and the bottom shape of the wooden trays on the dry weight of seedlings (mg).

The seedlings dry weight was estimated by drying 20 seedlings for each tray at 105^0C in an oven for 24 hours. The obtained results in Table (10) reveal that the average dry weight of seedlings for the plastic trays, perforated wooden trays and strips wooden trays were 22.3, 23.3 and 23.7 mg, respectively. The dry weight of seedlings in the wooden trays and the plastic trays was not significantly affected by the oil treatment and the bottom shape as shown in Fig. (13).

4.2.5. Influence of the oil treatment and the bottom shape for the wooden trays on the seedlings density (seedlings/ cm2).

The seedlings density was counted by taken 3 samples of size 1 cm^2 for each tray. The average seedlings density of 7.3, 7.1 and 7.2 seedlings/ cm^2 were for the plastic trays, perforated wooden trays and strips wooden trays, respectively. The statistical analysis in Table (10) show that the effect of the oil and the bottom shape on the seedlings density was not significant.

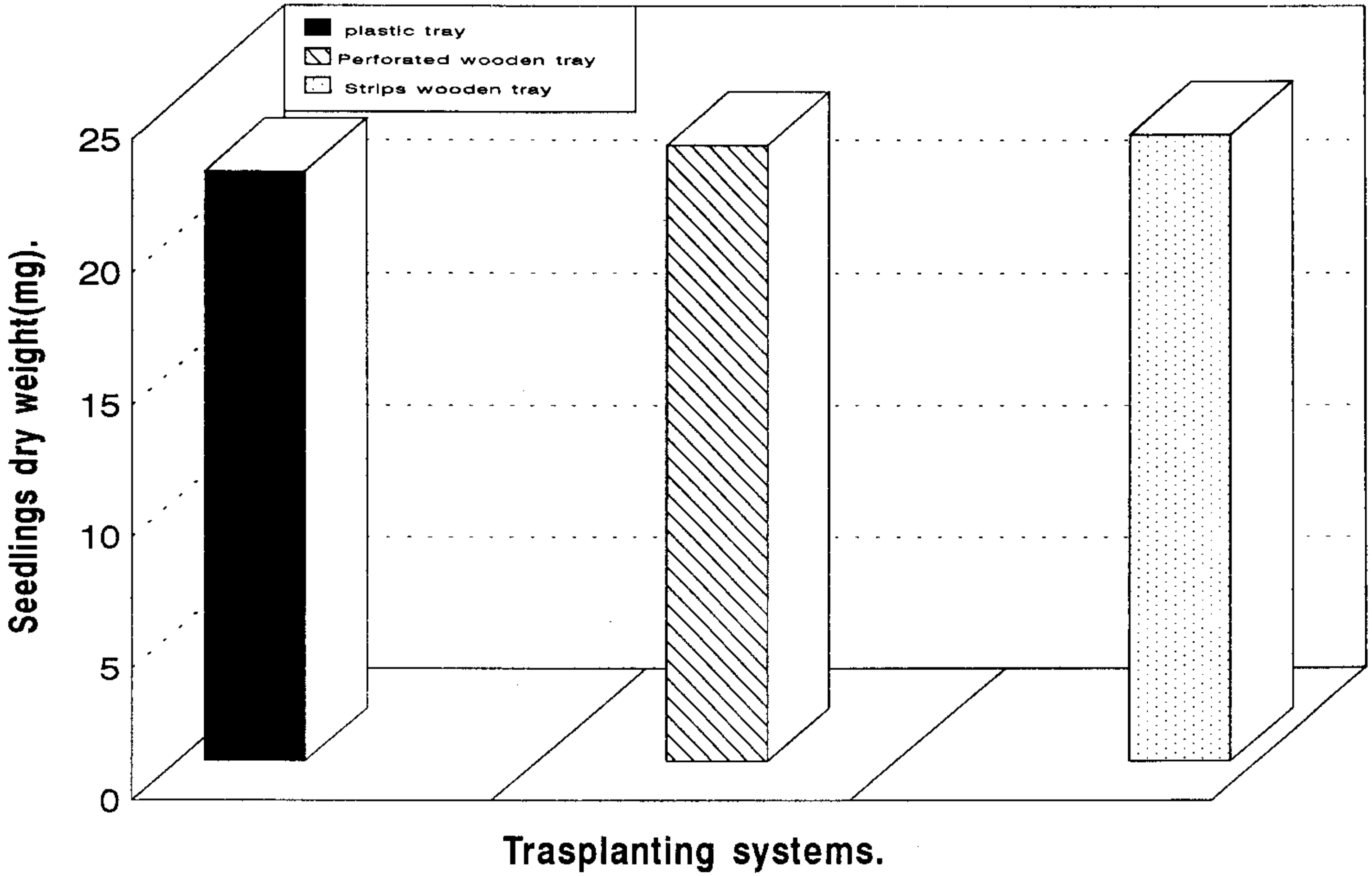

Fig. (13): Influence of the oil treatment and the bottom shape for the wooden trays on the dry weight of seedlings (mg).

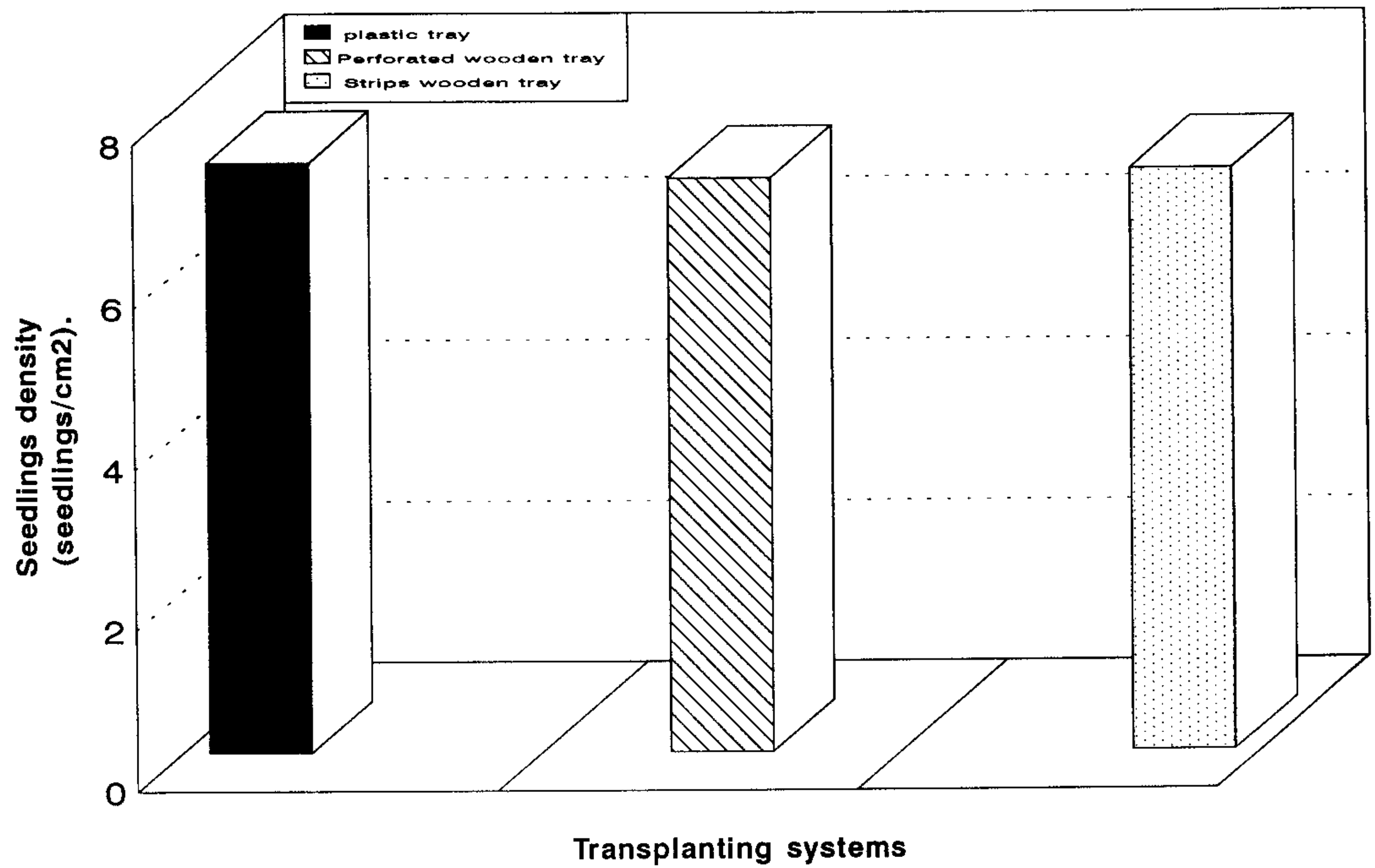

Fig. (14): Influence of the oil treatment and the bottom shape for the wooden trays onthe seedlings density.

4.3 Field experiment

4.3.1. Influence of the bottom shape for the wooden trays on the missed hills (%).

The represented data in Table (11) and Fig. (15) show that the average missed hill (%) were 13.89, 12.96 and 14.81 % for the plastic trays, perforated wooden trays and strips wooden trays, respectively.

A comparison between the three used trays, it was found that the missed hill (%) is not significantly affected as revealed by the statistical analysis in Table (11).

4.3.2. Influence of the bottom shape for the wooden trays on the sloped hill (%).

Data reported in Table (11) reveal the average sloped hills (%) were recorded by the plastic trays, perforated wooden trays and strips wooden trays were 6.48, 8.33 and 7.40 % respectively. It is obvious from Fig. (16) that the effect of the bottom shape for the three used trays is not significant on the slope hill (%).

Generally, although there was some bendings about 0.5 cm in the bottom for the perforated wooden trays after transplanting period, it had no influence on movement of seedlings on seedling mat.

4.3.3. Influence of the oil treatment for the wooden trays on grain and straw yield (t/ fed.).

Data reported in Table (12) and Fig. (17) reveal that the averages of the grain yield were 2.583, 2.644 and 2.821 (t/ fed.) for

Table (11): Influence of the bottom shape for the wooden trays on the missed and sloped hills (%).

Kind of trays	Missed hills (%)			Average	Sloped hills (%)			Average
	R1	R2	R3		R1	R2	R3	
Plastic	13.89	16.66	11.11	13.89	5.56	5.56	8.33	6.48
Perforated wooden	11.11	16.66	11.11	12.96	11.11	5.56	8.33	8.33
Strips wooden	16.66	13.89	13.89	14.81	8.33	8.33	5.56	7.40
F-test				N.S.				N.s.

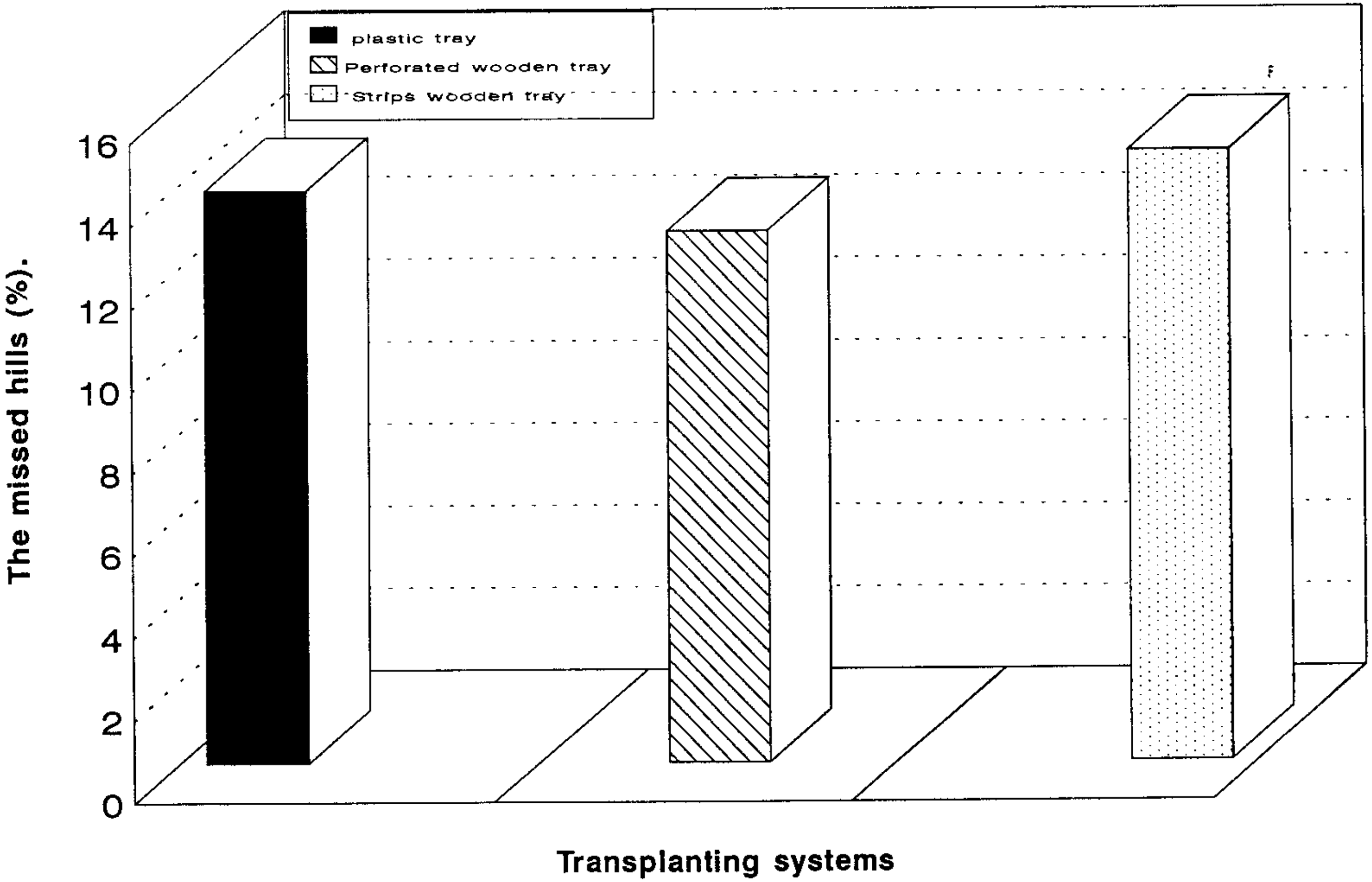

Fig. (15): Influence of the bottom shape forthe wooden trays on the missed hills (%).

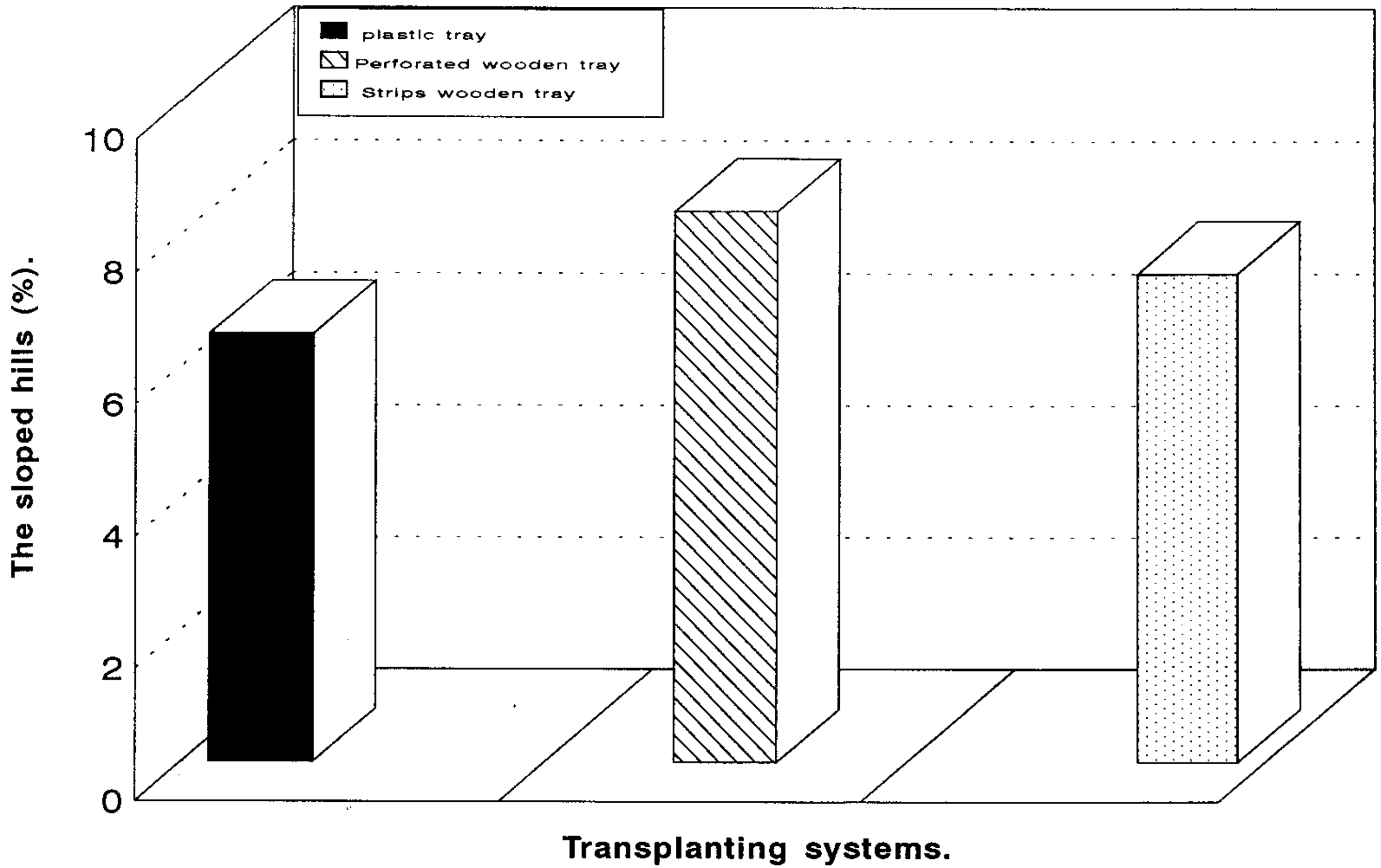

Fig. (16): Influence of the bottom shape for the wooden trays on the sloped hills (%).

Table (12): Influence of the oil treatment for the wooden trays on the grain and straw yield (t/fed)

Kind of trays	Crop yield (t/fed)			Average	Straw yield (t/fed)			Average
	R1	R2	R3		R1	R2	R3	
1-Plastic	2.877	2.310	2.562	2.583	3.108	2.961	3.696	3.255
2-Perforated wooden	2.499	2.835	2.604	2.646	3.171	3.213	3.486	3.290
3-Strips wooden	2.772	3.171	2.52	2.821	3.276	3.444	3.255	3.325
F-test				N.S.				N.s.

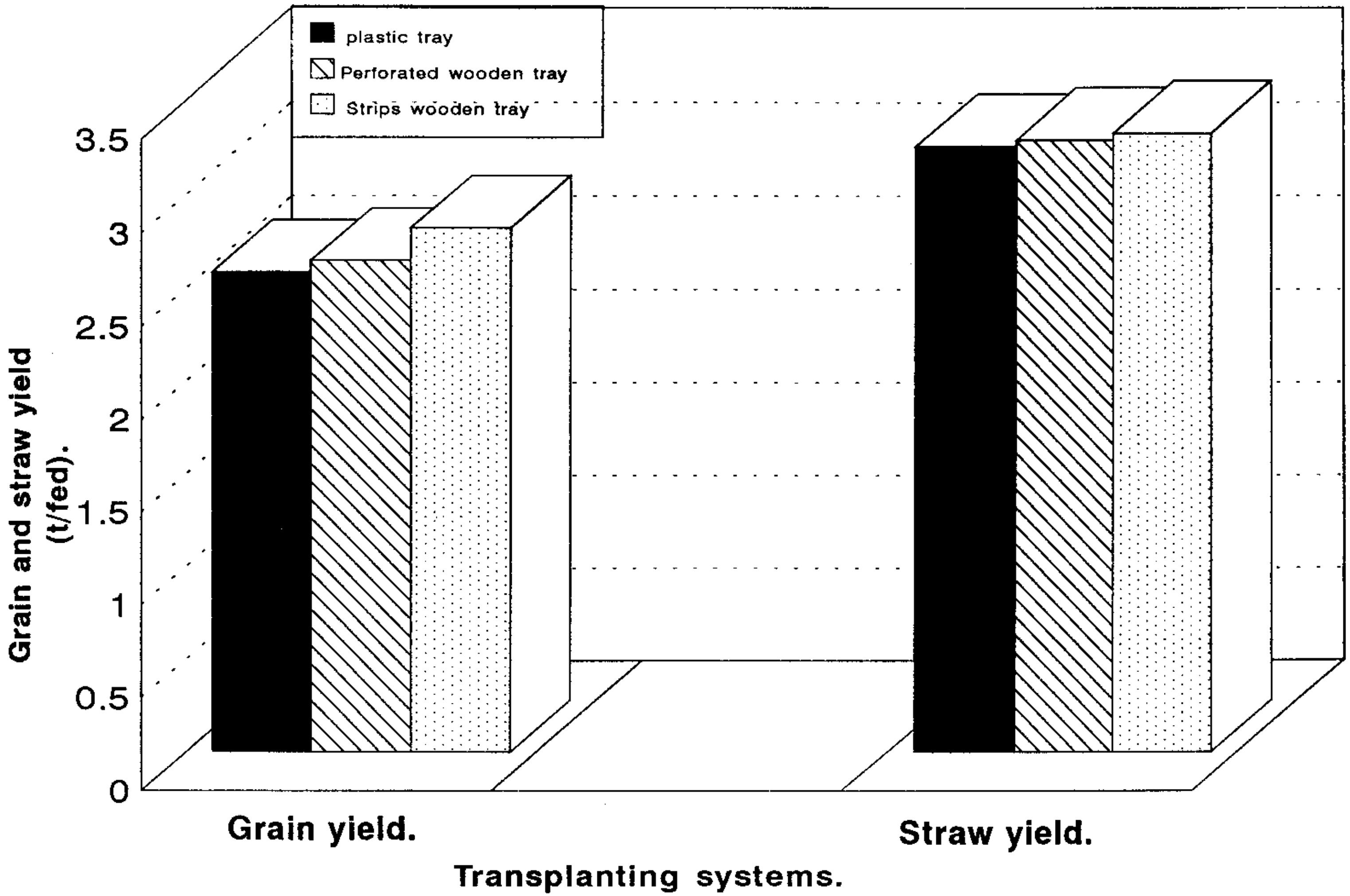

Fig. (17): Influence of the oil treatment for the wooden trays on grain and straw yield

the plastic trays, perforated wooden trays and strips wooden trays, respectively and the averages of the straw yield were 3.255, 3.290 and 3.325 (t/ fed.) for the plastic trays, perforated wooden trays and strips wooden trays, respectively. It seems from Table (12) that the treatment of the wooden trays with oil had no significant effect on both grain and straw yield.

4.4. Economical view

4.4.1. Comparative study between the mechanical and the traditional transplanting systems.

Data in Table (13) and Fig. (18) show the comparative study between the mechanical and the traditional transplanting,systems. Two types of trays were used under the mechanical transplanting plastic and the alternative trays i.e., wooden tray. The total costs for the transplanting operation including trays, seeds, nursery land rent, fertilizers, planting labour, transplanter and transplanting labour.

Raw data are presented in appendix (9) and (10) . Lowest total cost for transplanting operation was 152.75 LE/ fed. for mechanical transplanting by using wooden trays, followed by plastic trays and traditional transplanting, where cost were 242.75 and 292 LE/ fed. respectively. It is obvious from these results that, by using the wooden trays as alternative system to plastic trays, the total cost of transplanting were reduced by 90 LE/ fed.

Table (13): Comparative study between the mechanical and traditional transplanting systems

Cost Items	Mechanical transplanting		Traditional transplanting (LE/fed.)
	Plastic trays (LE/fed.)	Wooden trays (LE/fed.)	
A- Nursery preparation.			
1- Trays.	100	10	-
2- Seeds.	25	25	75
3- Nursery land rent.	0.3	0.3	14
4- Fertilizers.	1.25	1.25	13
5- Planting labour.	20	20	10
B-Transplanting operation.			
6- Transplanter	86.2	86,2	-
7-Transplanting labour.	10	10	180
Total.	242.75	152.75	292

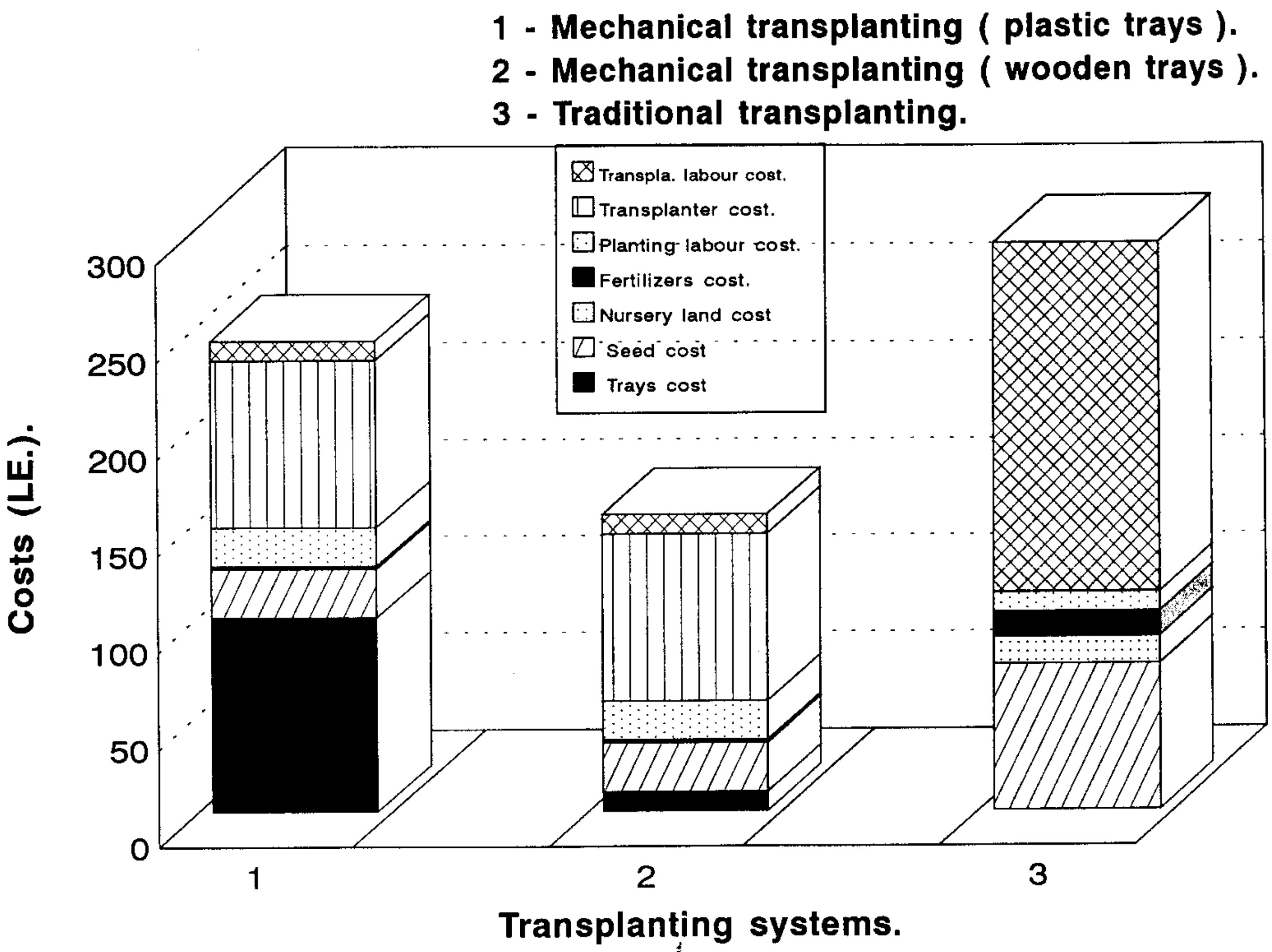

Fig. (18): Comparitve study between the mechanical and traditional transplanting systems.