



*23rd Session of the International Poplar Commission*  
***“Poplars, Willows and People's Wellbeing*”**

***Session 4-A: Short Rotation Forestry and biomass production***

**STUDIES OF POPLAR AND WILLOW  
SHORT ROTATION COPPICE ESTABLISHMENT**

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*CRA - Research Unit Wood production outside forest  
Casale Monferrato Italy*

***Beijing, China, 26- 30 October 2008***

# SRC

During the last 6 years over 5000 hectares have been planted in Italy, mainly in the Po valley.

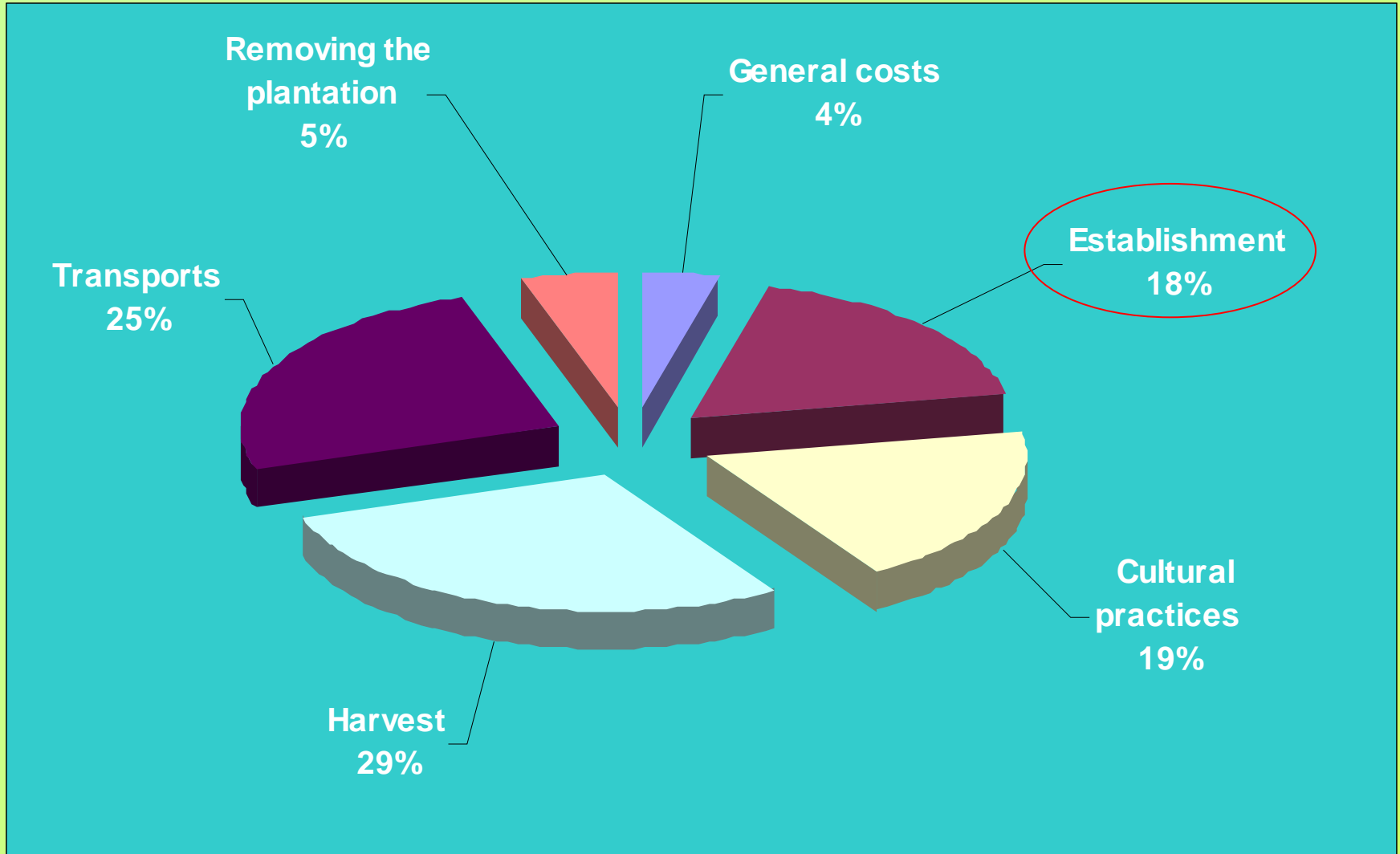


Annual rotation

Biennial / triennial rotation

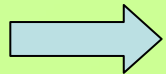


# SRC Costs

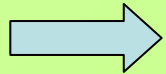


# Aims of this work

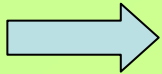
Evaluation of the influence on biomass production of:



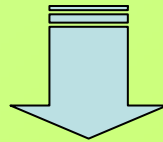
different planting materials



different transplanting machines



species and clones



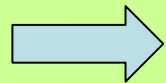
**3 trials**

**Site: experimental farm Mezzi (CRA-PLF)**

**Casale Monferrato Italy**

# 1<sup>st</sup> Trial

A quick and an accurate method of cutting preparation were compared.



**Electric machine  
(accurate method)**



**Prototype Berni  
(quick method)**



**Species and clone:**

✓ *Populus* × *canadensis* clone Orion

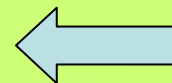
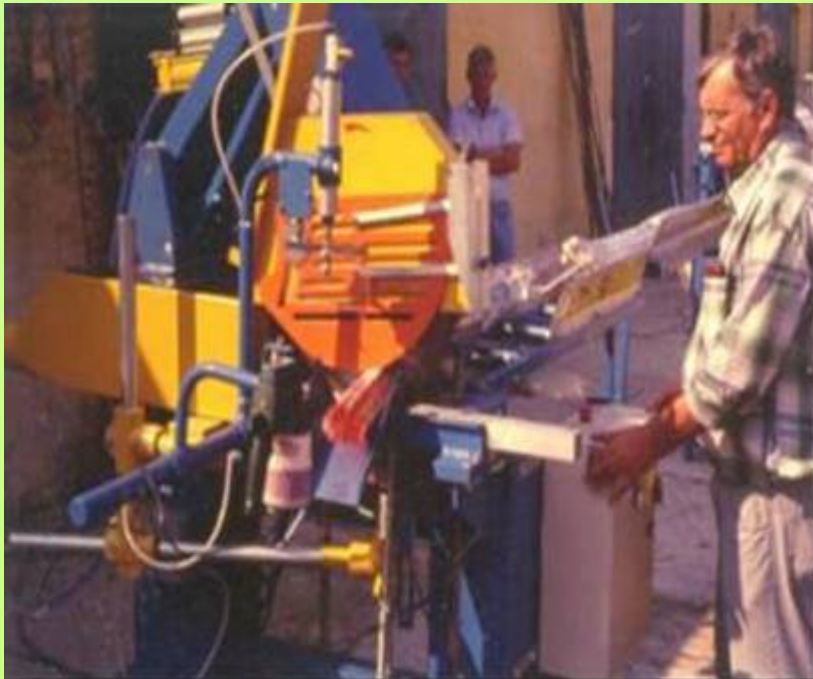
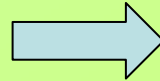
✓ *Salix matsudana* × ? clone Levante

✓ *Salix matsudana* × ? clone S76-008

# 1<sup>st</sup> Trial

**Electric machine**

**500-600 cuttings · h<sup>-1</sup>**



**Prototype Berni**  
**3000 cuttings · h<sup>-1</sup>**

# 2<sup>nd</sup> Trial

## Comparison among 3 transplanting machines

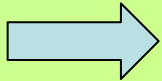
*Populus* × *canadensis* clones I-214 and Neva mixed

*S. matsudana* × ? clones Levante and S76-008 mixed

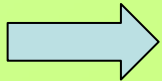
(cuttings 20 cm long)



**Rotor**



**Oliver**



**Alasia**

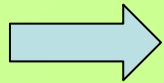
# 2<sup>nd</sup> Trial

## Comparison among 3 transplanting machines

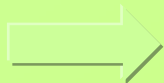
*Populus* × *canadensis* clones I-214 and Neva mixed

*S. matsudana* × ? clones Levante and S76-008 mixed

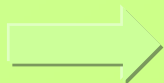
(cuttings 20 cm long)



Rotor



Oliver



Alasia



Speed: 1 km·h<sup>-1</sup>  
Workers:3  
Row:1  
Power: 40 KW  
Prod.: 0.3 ha·h<sup>-1</sup>

(Source:Balsari 2007)





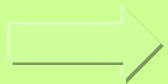
# 2<sup>nd</sup> Trial

## Comparison among 3 transplanting machines

*Populus* × *canadensis* clones I-214 and Neva mixed

*S. matsudana* × ? clones Levante and S76-008 mixed

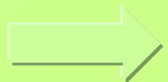
(cuttings 20 cm long)



Rotor



Oliver



Alasia



Speed: 1.1 km·h<sup>-1</sup>

Row:2

Prod.: 0.6 ha·h<sup>-1</sup>

Workers:4

Power: 60 KW

(Source:Balsari 2007)

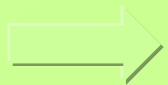
# 2<sup>nd</sup> Trial

## Comparison among 3 transplanting machines

*Populus* × *canadensis* clones I-214 and Neva (mixture)

*S. matsudana* × ? clones Levante and S76-008 (mixture)

(cuttings 20 cm long)



Rotor



Oliver



Alasia

Speed: 1.2 km·h<sup>-1</sup>

Workers:3

Row:1

Power: 45 KW

Prod.: 0.4 ha·h<sup>-1</sup>

(Source:Balsari 2007)

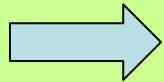


# 3<sup>rd</sup> Trial

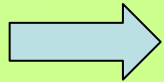
## Establishment with and without plastic mulch

*Populus* × *canadensis* clone I-214

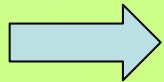
*Salix matsudana* × ? clone Levante



Spapperi with plastic mulch



Rotor without mulch



Rotor with plastic mulch



# 3<sup>rd</sup> Trial

## Establishment with and without plastic mulch

*Populus* × *canadensis* clone I-214

*Salix matsudana* × ? clone Levante



Spapperi with plastic mulch



Rotor without mulch



Rotor with plastic mulch



Speed: 1 km·h<sup>-1</sup>

Workers:3

Row:1

Power: 40 KW

Prod.: 0.3 ha·h<sup>-1</sup>

(Source:Balsari 2007)

# 3<sup>rd</sup> Trial

## Establishment with and without plastic mulch

*Populus × canadensis* clone I-214

*Salix matsudana* × ? clone Levante

→ Spapperi with plastic mulch

→ Rotor without mulch

→ Rotor with plastic mulch

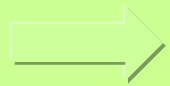


# 3<sup>rd</sup> Trial

## Establishment with and without plastic mulch

*Populus* × *canadensis* clone I-214

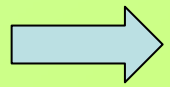
*Salix matsudana* × ? clone Levante



Spapperi with plastic mulch



Rotor without mulch



Rotor with plastic mulch



# Trial characteristics

2004

Planting year

2002

## Cutting preparation

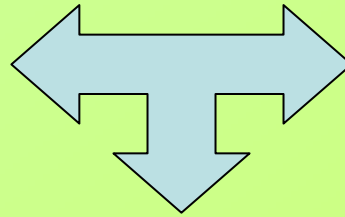
Surface.: 2.500 m<sup>2</sup>

Rows n° : 3

Spacing: 2,40 × 0,51 m

Density: 8.170 p. ha<sup>-1</sup>

Exp. design: split-plot  
with 3 rep.



2004

## Establishment with/without mulch

Surface.: 1.600 m<sup>2</sup>

Rows n° : 3

Spacing: 2,40 × 0,51 m

Density: 8.170 p. ha<sup>-1</sup>

Exp. design: split-plot  
with 3 rep..

## Comparison among 3 transplanting machine

Surface.: 5.400 m<sup>2</sup>

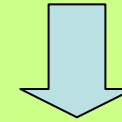
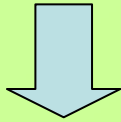
Rows n° : 3

Spacing: 1,90 × 0,70 m

Density: 7.500 p. ha<sup>-1</sup>

Exp. Design: complete  
randomized block  
with 3 rep.

# Cultural Practices



**2002**

**2004**

years						
0	1	2	3	4	5	6
	4		1			
		1	1	1	2	1
	5					
	1	4	3	3	2	1

years				
0	1	2	3	4
	3	1		
		1	1	
	5	5	2	
	5	4	1	


- PK Fertilisation**
- Ploughing**
- Harrowing**
- Chemical weed control**
- Disc harrowing**
- Mechanical weed control**
- N Fertilisation**
- Pest control**
- Irrigation**
- Harvesting**



# Variables recorded



**Rooting of cuttings or survival of plants/stumps**



**Growth**

- diameter at breast height (only living shoots with height > 150 cm)
- number of died shoots with height > 150 cm or < 150 cm
- number of living shoots with height < 150 cm
- diameter at 10 cm of height and total height on a sample



**Production**

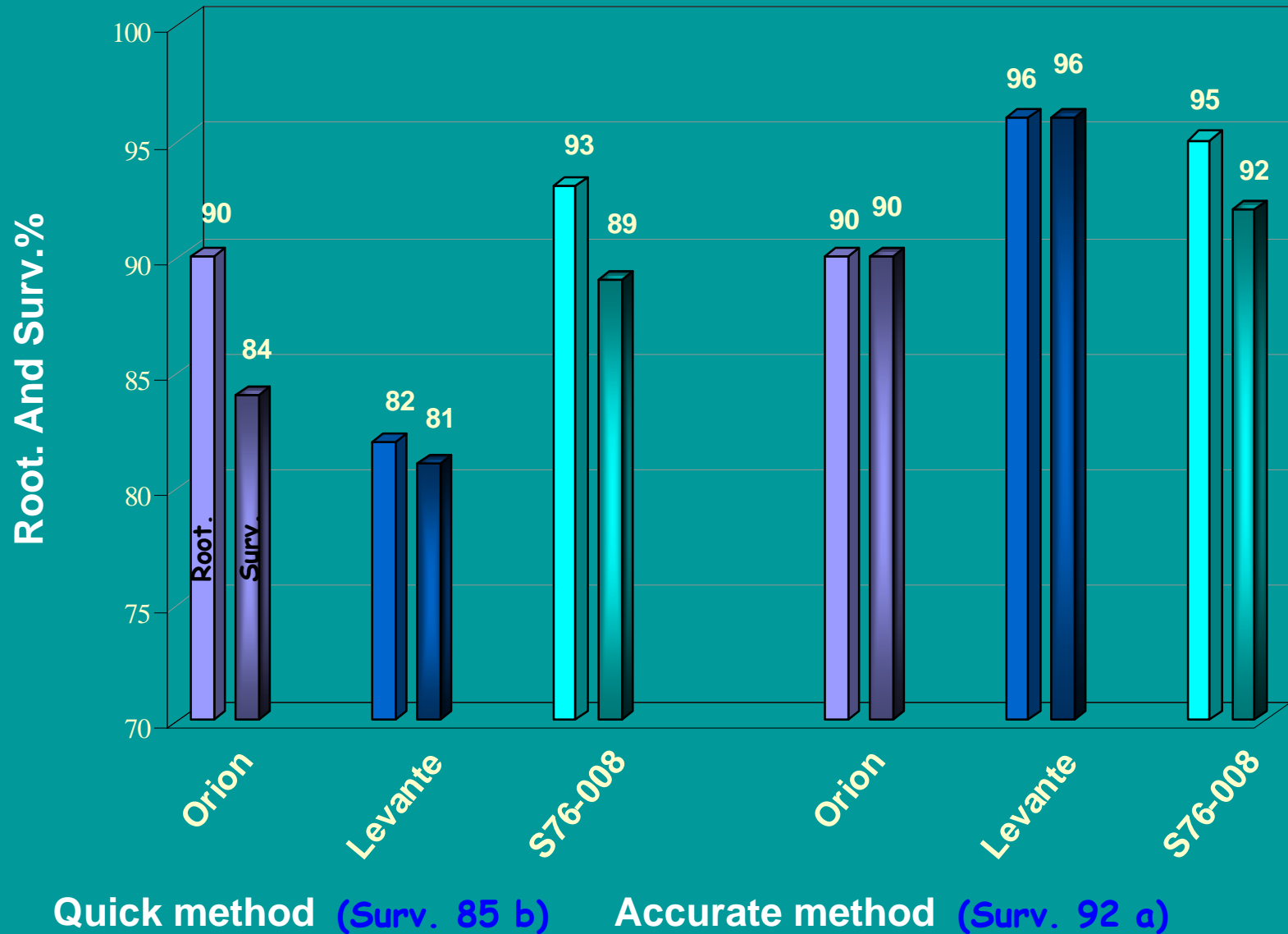
- total wet weight
- dry weight on a sample

# Dry biomass estimation

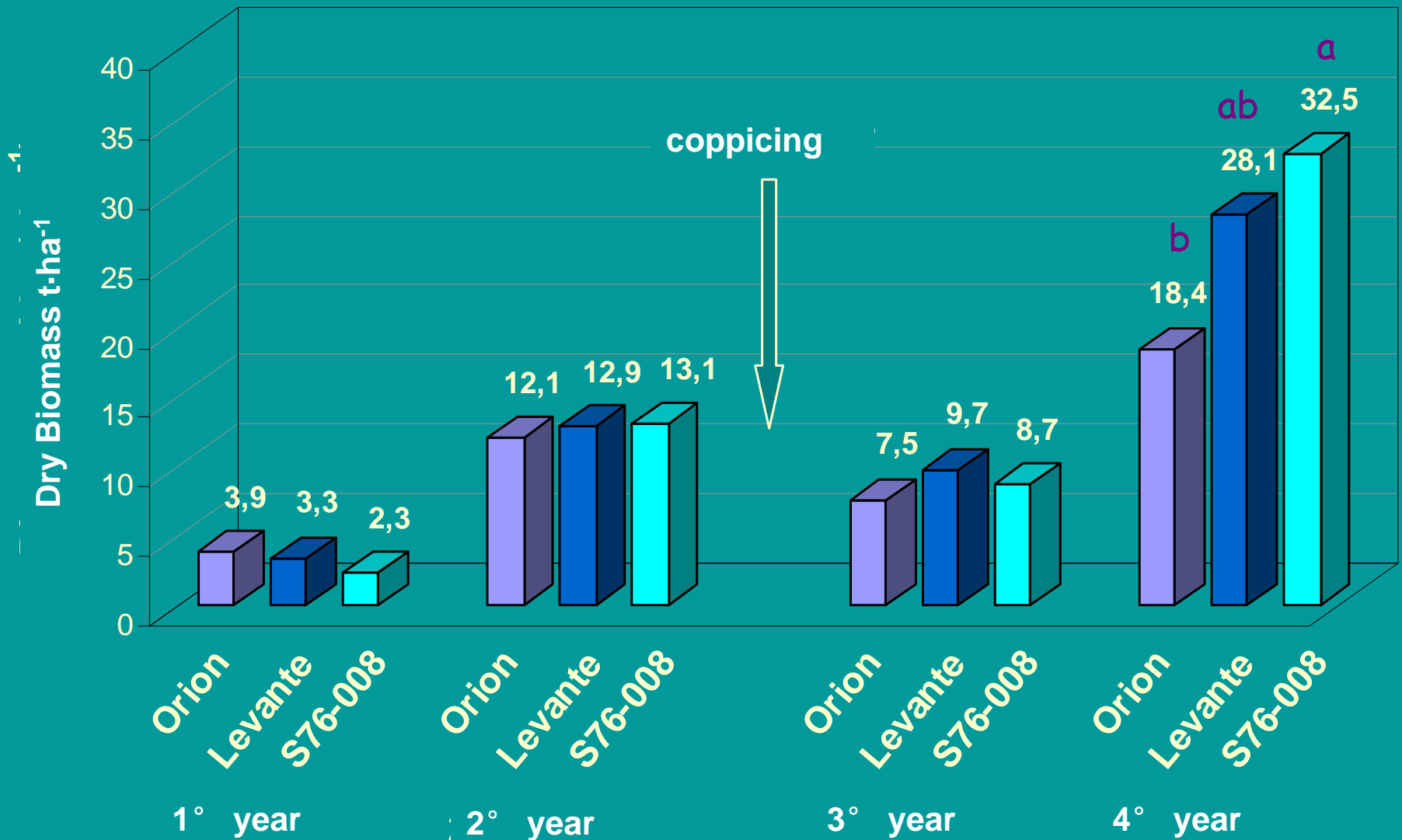
$$\text{Dry weight} = b \cdot D_{130}^c$$

Genus	b	c	R <sup>2</sup>
<i>Populus</i>	0,556	2,195	0,936
<i>Salix</i>	0,135 · 10 <sup>-6</sup>	2,702	0,897

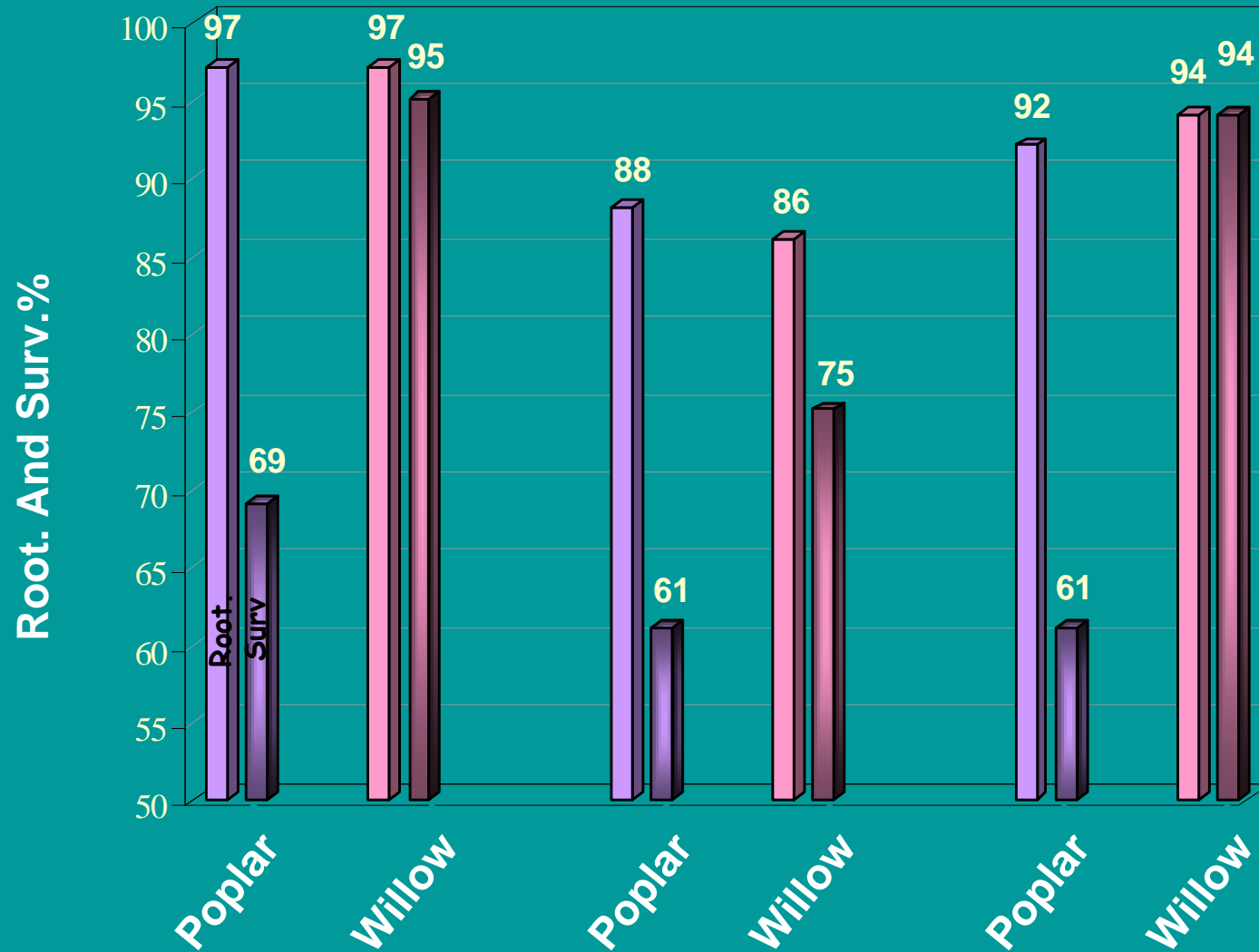
# Trial 1 - Cutting preparation method



# Trial 1 - Cutting preparation method

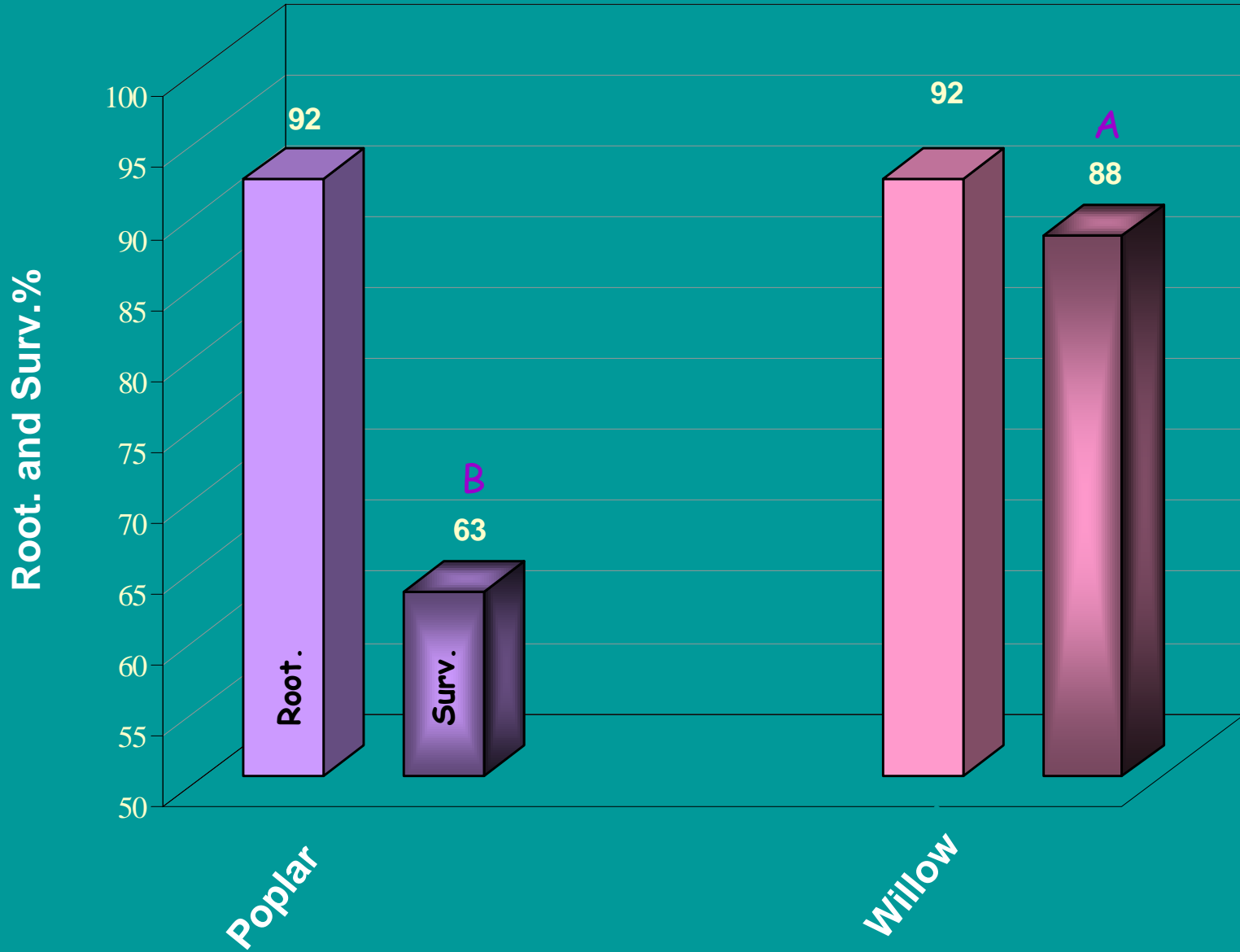


# Trial 2 - Comparison among transplanting machine

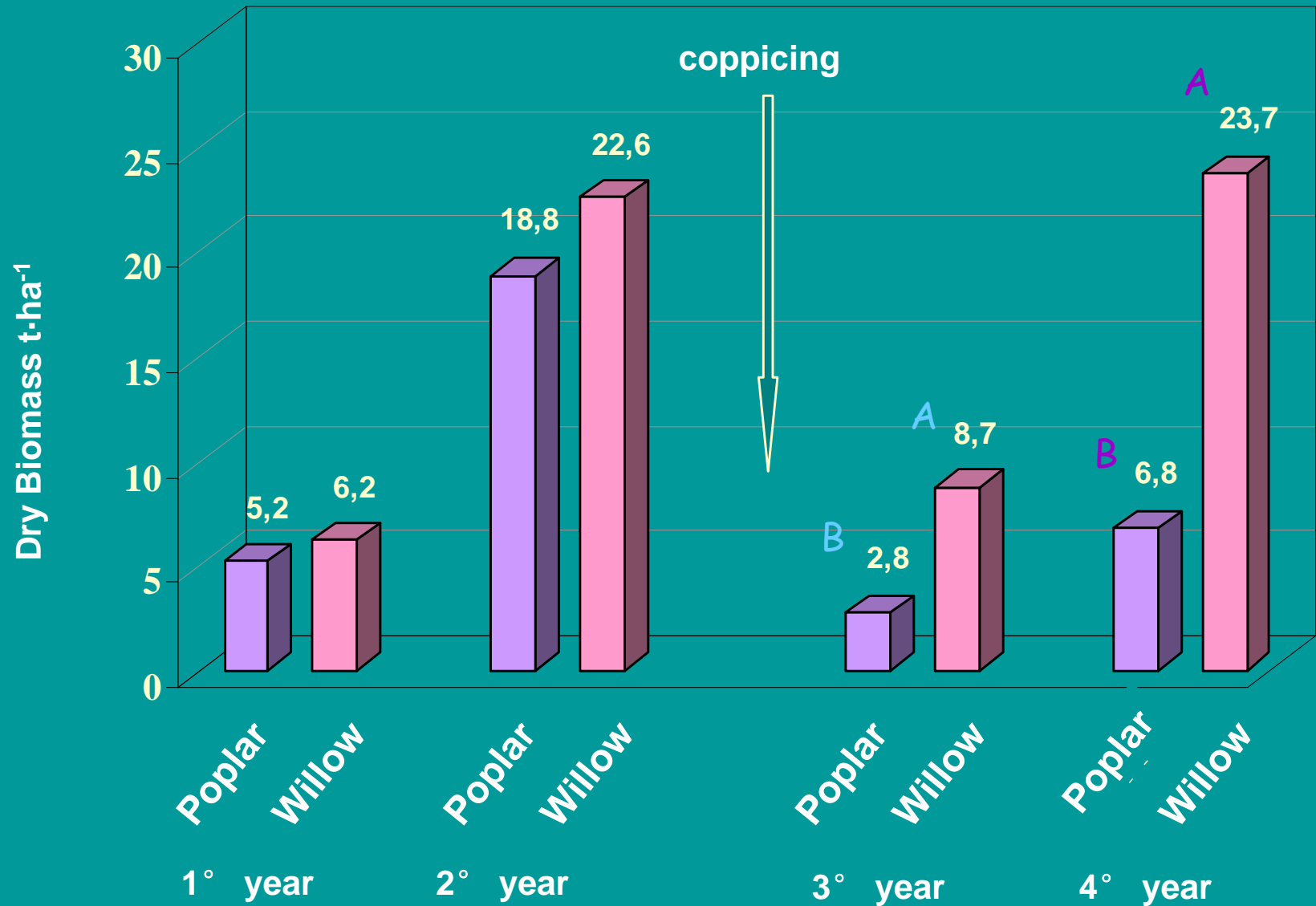


Rotor (Root. 97 A) Oliver (Root. 87 B) Alasia (Root. 93 AB)

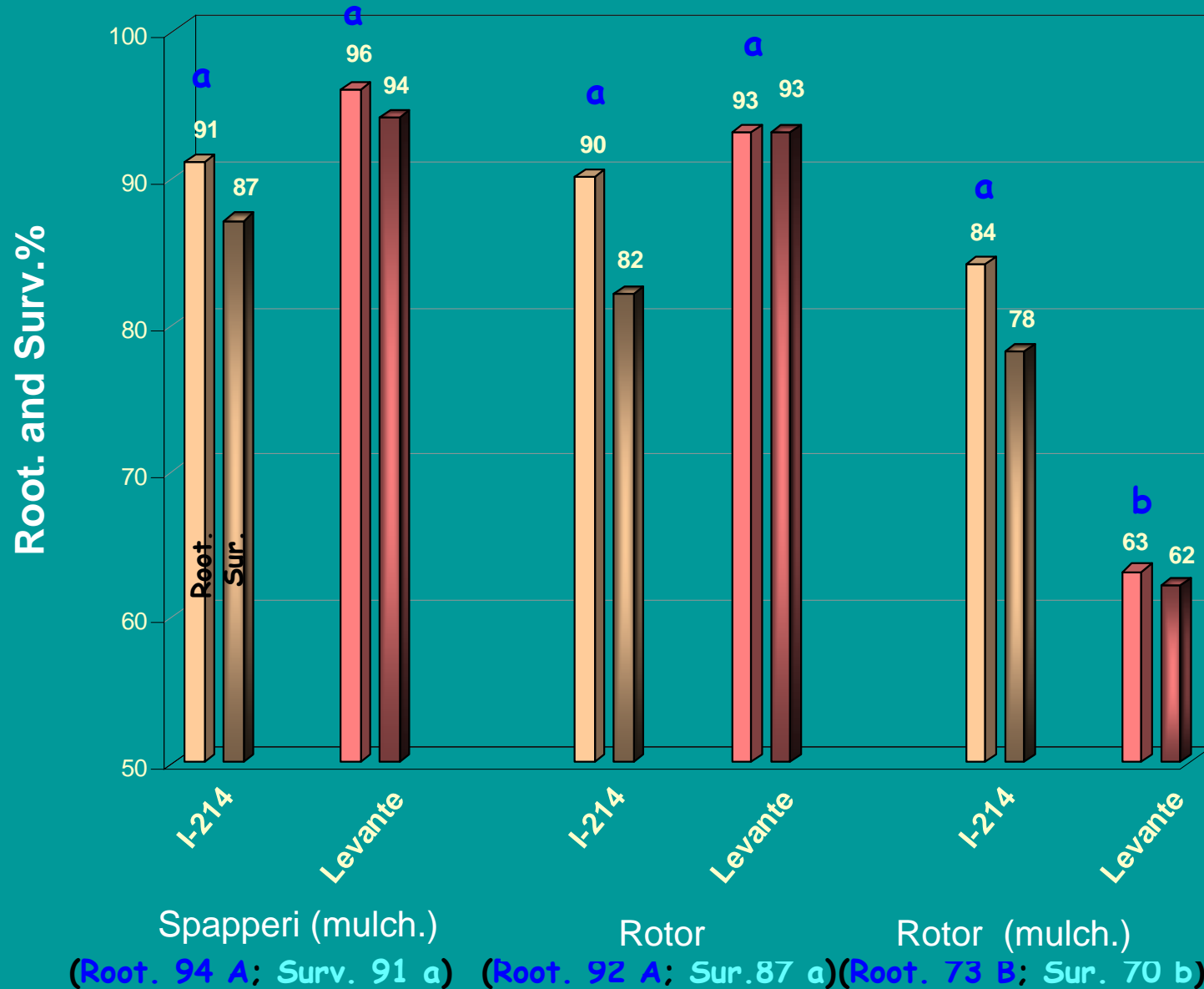
# Trial 2 - Comparison among transplanting machine



# Trial 2 - Comparison among transplanting machine

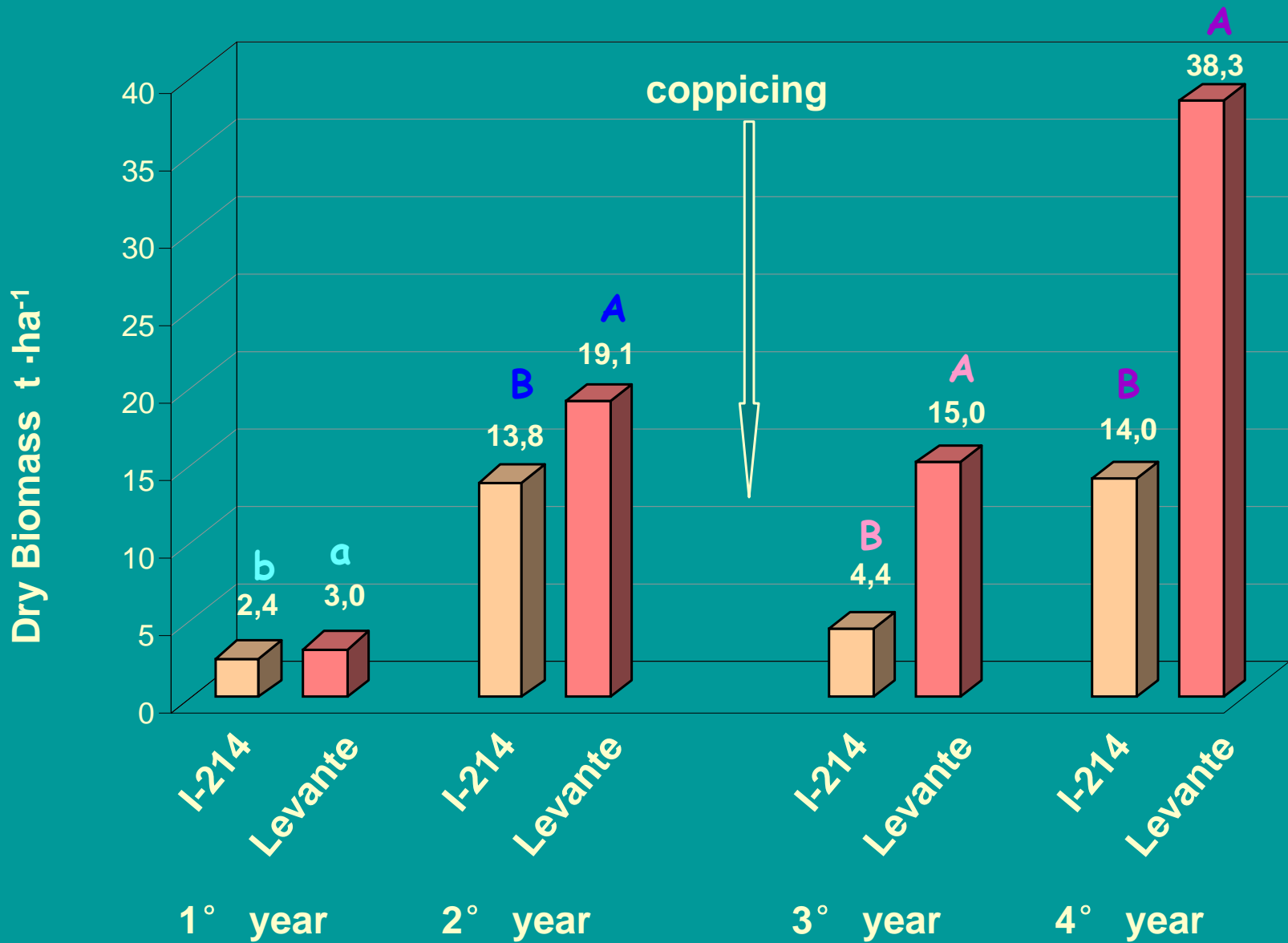


# Trial 3 - Establishment with/without plastic mulch





# Trial 3 - Establishment with/without plastic mulch



# Conclusions

## 1<sup>st</sup> trial

There were no statistically significant differences between the accurate and the quick cutting preparation methods, for rooting, tree survival or production during 1<sup>st</sup> rotation.

## 2<sup>nd</sup> trial

The transplanting machines had a highly significant influence on rooting % in the first year.

## 3<sup>rd</sup> trial

Plastic mulching, which eliminates the problem of chemical weed control, can be used only if the cuttings are planted 4-5 cm above the ground. In this trial planting machines did not have a strong influence on production, but differences among species and clones were significant in the first year and highly significant at the end of the cycle.

The willow clones utilized had greater productivity than the poplars.

Thank you for your attention

