

Identification of 'plus' sycamore trees in the North of Ireland for seed procurement

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Aims

Identify 'plus' *Acer pseudoplatanus* trees in the north and northwest of Ireland based on our current knowledge of sycamore biology, ecology and tree architecture (see Binggeli & Rushton 199). Gather seeds from as many of the identified trees as possible.

Background

In the Irish countryside nearly all sycamore trees have a poor shape and do not appear to grow well. Sycamore is a highly variable species and many of its characteristics may, in some individuals, be detrimental to the production of a fast growing tree crop and of sufficient quality.

As sycamore is one of the most extensively investigated European broadleaf tree species, many aspects of its biology and ecology, relevant to the production of high quality timber, are now well understood. This knowledge can now be applied to the identification of 'plus' trees so that the quality of the planting material currently used in farm forestry in Ireland may be improved. Current planted material is mainly from European origin but of unknown provenances although the seeds are thought to originate from certified stands.

Biological and ecological attributes identified as important in the identification of 'plus' trees

Prior to the field survey a list of desirable and undesirable tree characteristics was drawn and the following attributes were identified as important:

- Branching pattern
- Forking
- Growth rates
- Sylleptic shoots
- Basal sprouting
- Self-pruning
- Flowering intensity
- Fruiting intensity
- Sex expression
- Stem shape

Of course the impact of these attributes on timber production and quality is not always fully known and our

current understanding is given in some detail below.

Sex expression, flowering intensity and fruiting intensity affect tree increment growth and branching pattern. Although branching pattern is strongly affected by the above characteristics it is also a highly heritable character and varies much from tree to tree, but it is also affected by environmental factors and exposure in particular. Ideally a sycamore tree to be used in forestry plantations would have the following characteristics:

- male flowering,
- no flowering when young,
- low flowering intensity when adult,
- stout shoots and have sylleptic shoots,
- low aphid counts,
- late leaf fall,
- no basal sprouting,
- good self-pruning,
- strong apical dominance,
- horizontal or slightly angled branches,
- large upper canopy,
- round stem, and
- no crown dieback.

At present casual observations suggests that trees with large buds suffer from less terminal bud death than individuals with small buds and should be selected for.

Field work strategy

In late September and early October 1998, sites known or thought to have good sycamore were visited in Cos Antrim, Derry, Donegal, Leitrim and Sligo. In between these sites driving was carried out on country roads identified from maps as having the greatest likelihood of encountering sycamore. All trees with major defects, such as poor branching pattern, lack of apical dominance and crown dieback, were rejected.

Seeds were collected from trees identified as 'plus' trees. Not all trees had seeds and some could not be sampled due to the great height of the seed bearing branches. Branches below a height of 6m were sampled and wherever

necessary a pruning pole was used.

Selected 'plus' trees

Thousands of trees were observed during the investigation, however very few individuals exhibited an acceptable stem and/or crown forms. Trees identified during the survey are listed in Tables 1 and 2. Trees from which seeds could be gathered are listed in Table 1 and for each tree site and tree characteristics are given. 'Plus' trees, from which seeds could not be obtained, are listed in Table 2. Table 3 gives a rating for all tree as well as the main positive and negative characteristics identified during the

survey. The following points can be made about the nature of the trees identified (please note that a number points listed below are discussed in some detail in a Coford report by Binggeli & Rushton 1999).

- Nearly all trees were planted last century as amenity trees on large estates. Exceptions include the tree at L. Errig which is adjacent to a farm and one of the Bunrana trees which is in fact the progeny of a planted tree. The reason(s) for 'plus' individuals being found on estates is unclear but it is probable that it is a result of better seed source rather than silvicultural techniques. 20th century planting did not yield any suitable trees.

Table 1. Site and tree characteristics of plus trees from which seeds were collected.

Tree number	M1	M2	M3	M4	P1	G1	F1	F2
Site characteristics								
Location	Murlough Bay	Murlough Bay	Murlough Bay	Murlough Bay	Portstewart	Gransha	Foyle Bridge	Foyle Bridge
County	Antrim	Antrim	Antrim	Derry	Antrim	Derry	Derry	Derry
Grid reference	D193420	D195422	D195422	D196422	C835374	C463195	C450196	C450196
Altitude	90	30	30	10	20	20	20	20
Aspect	E	E	E	E	-	SW	SE	SE
Exposure	Shelter	medium	medium	high	shelter	shelter	shelter	medium
Stand type	woodland	hedge	hedge	isolated	woodland edge	woodland	woodland	hedge
Substrate	scree	soil + rocks	soil + rocks	soil + rocks	soil	soil	soil	soil
Ground vegetation	nettle bracken nettle	grass bracken nettle	grass	grass	bramble	bare	bare	grass
Tree characteristics								
Diameter (cm)	55	55	60	75	55	70	75	80
Height (m)	16	15	17	18	15	20	22	20
Height 1st branch (m)	3.5	2.5	2	2.5	3	4	5.5	3
Forking height (m)	6	7.5	8	6	12	7	7	5.5
Bark type	smooth	flaking	rough	rough	smooth	rough	smooth	rough
Crown competition (%)	70	50	50	20	60	60	70	60
Species 1	larch	beech	beech	sycamore	sycamore	beech	sycamore	sycamore
Species 2	ash	elm	ash		chestnut	oak	elm	
Species 3	sycamore				beech			
Shoot growth	average	slow	good	average	average	good	average	average
Shoot thickness	slender	stout	stout	stout	medium	medium	medium	medium
Sylleptic shoot	no	no	yes	yes	no	no	no	no
Basal sprouts	no	no	no	no	few	strong	no	few
Bud size	small	big	big	big	average	small	average	small
Flowering intensity (%)	40-50	40-50	40	40	40-50	40-50	40-50	50
Sex expression	po	po	po	pa	po	po	po	pa
Schizocarpy (%)	29	53	73	3	79	0	13	6

(po = protogynous, pa = protandrous)

Cont.

Table 1 (cont.). Site and tree characteristics of plus trees from which seeds were collected.

Tree number	Bu1	Bu2	E1	Do1	Ba1	Dr1	Dr2
Site characteristics							
Location	Buncrana	Buncrana	Lough Errig	Donegal	Ballyshannon	Drumcliff	Drumcliff
County	Donegal	Donegal	Donegal	Donegal	Donegal	Sligo	Sligo
Grid reference	C345328	C345328	B891023	G925771	G864611	G681421	G681421
Altitude	10	10	150	10	15	10	10
Aspect	S	S	SE	-	-	-	-
Exposure	shelter	shelter	high	medium	medium	medium	medium
Stand type	hedge	hedge	hedge	open woodland	hedge	hedge	hedge
Substrate	soil + wall	soil	soil	soil	soil	soil	soil
Ground vegetation	nettle	grass	grass	grass	grass	bare	bare
Tree characteristics							
Diameter (cm)	25	85	70	90	60	70	85
Height (m)	12	15	15	18	15	20	18
Height 1st branch (m)	0.5	3.5	1.6	2	3	2	5
Forking height (m)	8	5.5	6	8	6.5	8	6.5
Bark type	smooth	rough	smooth	rough	rough	rough	rough
Crown competition (%)	70	50	50	40	40	40	40
Species 1	ash	sycamore	sycamore	sycamore	sycamore	sycamore	sycamore
Species 2	sycamore	ash		beech			
Species 3		pine					
Shoot growth	average	slow	average			average	
Shoot thickness	stout	stout	slender			stout	
Sylleptic shoot	no	no	no	no	no	no	no
Basal sprouts	no	no	no	no	no	no	no
Bud size	small	average	small	small		big	
Flowering intensity (%)	50	50	40	40	40	40	50
Sex expression	po	pa	po	pa	po	pa	pa
Schizocarpy (%)	10	1	3	1	3	0	0

(po = protogynous, pa = protandrous)

- The majority of the trees were initially grown in rather open conditions (i.e. woodland edge, hedgerow or open ground).

- Two trees were selected because of their ability to withstand extreme conditions. One grows 10m away from the shore at Murlough Bay (Co Antrim), a very exposed and cold site, and without any shelter, yet the tree has a straight enough trunk although it clearly suffers from much wind and salt damage. The other is located near L. Errig (Co Donegal) and the tree is growing next to a farmstead in a exposed valley nearly denuded of any trees, but still manages to grow straight to a good height.

- Not all trees have a full complement of required characteristics. Some were selected mainly because they exhibited a desirable trait not readily observed in other individuals (e.g. Do1 which has large horizontal branches

spreading up to 15 m away from the trunk).

Shortcomings of the investigations

A number of factors could not be addressed during such a small survey. The main shortcomings are:

- Lack of knowledge of the diameter increment of the selected trees. Although some indications can be gained from shoot architecture and extension growth, no reliable estimate of diameter increment growth can be given unless the trees are cored and a ring growth investigation is carried out.

- Only a substantial research programme could unravel the interrelationships between several of the characteristics listed in Table 1.

- The two 'exceptional trees' (Sligo and Learmount) and

two 'very good trees' (Drumcliff, Rallagh) (Tables 2 & 3) were not sampled due to the inaccessibility of the seeds (height above 6 m) using a standard pruning pole.

- In the literature there are indications that male trees are faster growing than individuals with mixed sexuality. It is interesting to note that the majority of individuals identified as 'plus' trees are protogynous, that is individuals which function predominantly as female.

- Easily gathered data has been included in Table 1, however the significance of some of the characteristics (e.g. schizocarpy - fruits with more than two samaras) or bark type to the selection of 'plus' trees is not clear.

- A photographic record of all identified trees was made. Unfortunately the unprocessed film was destroyed due to a camera's mechanical problem. It is intended to obtain photographs of most of the trees in due course.

Future prospects

In order to gain a better understanding of the quality of the seeds collected a small provenance trial is to be initiated. Around 200 seeds from all collected trees have been kept at Coleraine and will be grown at the University in 1999. Seedlings will be subsequently planted out using a proper experimental design in 2000. These seedlings will be compared with material originating from commercially available seed sources. It is intended to plant these seedlings at three contrasting sites (sheltered, coastal and

upland).

Recommendations

Seeds of all trees are supplied in separate lots and it is recommended that at least two seed lots (M4 and E1) should be grown separately. These two trees may have characteristics which makes them highly tolerant of exposure in respectively open coastal and upland conditions.

- In order to enhance growth young sycamore plantations should be grown with some shelter as shown by our 1997 investigations. If need be shelterbelts of fast growing trees should be established.

- Based on our long-term investigations of the reproductive biology of sycamore and our observations that 1998 was both a good seed year and a year with a poor summer, with low maximum summer temperatures, it is forecasted that the 1999 sycamore seed production will be very low. Full use of the seeds must be made next spring as the next good seed year will be in the Autumn 2000.

Reference:

Binggeli P. and B.S. Rushton (1999) Sycamore and ash - A review of aspects relevant to Irish forestry. COFORD, Dublin.

Table 2. Other individuals identified as plus trees which failed to produce seeds or seeds were at a height greater than 6 m and therefore not readily accessible.

Site	County	Grid reference	Tree characteristics and rating
Rallagh (R1)	Derry	C665073	Good tree growing in forest, but no seed produced. Does not appear to be very fast growing
Learmount (L1-3)	Derry	C578024	Three good trees identified including an exceptional individual. This tree has a clear stem up to around 10m. No seeds could be gathered.
Drumcliff (Dr3)	Derry	G681421	Excellent shape, with no branches below 8m. Stem not straight but thought to be due to site exposure
Sligo (S1)	Sligo		Tall tree with straight trunk. The small size of canopy (short side branches) may in fact be detrimental to growth.
Sligo (S2)	Sligo		Tree with a large, although short (4m), lower stem.

Table 3. Summary of table of positive and negative characteristics in identified plus trees.

Tree	Seed	Quantity gathered	Tree quality	Main positive characteristic(s)	Main negative characteristic(s)
M1	yes	large	very good	Very good stem	Slow(?) growth
M2	yes	large		Good overall shape and growth	Lower branches too strong
M3	yes	large		Good overall shape and growth	Large lower branch arching upward
M4	yes	large		Good shape with unforked stem, exceptional shape for such an exposed site	Tree generally battered by wind and salt
P1	yes	medium	very good	No stem forking for up to 80% of tree height. This suggest that terminal buds do not flower much, the opposite of what sycamore normally exhibit. This lateral flowering tendency, known to occur in other maple species, may be an unusual characteristic which could be used in a breeding programme.	Slow(?) growth
G1	yes	large	good	Good overall shape	Basal sprouts and one large side branch reaching canopy height.
F1	yes	medium	very good	Straight tall stem	Damage to base, probably caused by machinery
F2	yes	large	good	Good overall shape and growth	Low forking height
Bu1	yes	medium	very good	Straight stem, high forking, horizontal branches	Regular heavy fruiting
Bu2	yes	small	good	Big tree with good branching	Low forking
E1	yes	large	good	Good overall shape	Very low forking (thought to be due to extreme exposure)
Do1	yes	small	good	Strong horizontal lateral branches	Lack of stem diameter increment above 3m
Ba1	yes	medium	good	Good overall shape	Slow (?) increment growth
Dr1	yes	large	good	Good overall shape and growth	After the first fork a side branch became leader
Dr2	yes	small	good	Good overall shape and growth	Stem not straight, but thought to be due to site exposure
Dr3	no		very good	Excellent shape, with no low branches	Slow (?) growth
R1	no		very good	Straight stem, good branching	Slow (?) growth
S1	no		excellent	Straight trunk with small horizontal branches	Average increment growth
S2	no		good	Straight stem, large canopy	Straight stem length limited
L1	no		excellent	Very tall straight stem, best tree observed during survey	None observable
L2	no		good	Tall straight stem	Strong upper branches at an angle of 45 or more
L3	no		good	Tall straight stem	Strong upper branches at an angle of 45 or more