Vegetative Regeneration of Japanese Knotweed

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Vegetative regeneration of Japanese knotweed: Objective

Introduction - Japanese knotweed has the reputation as being one of the most invasive plants

The purpose of this presentation is to explore vegetative regeneration of Japanese knotweed

There is little evidence of sexual reproduction of Japanese knotweed *(Fallopia japonica,* syns = *Reynoutria japonica*, *Polygonum cuspidatum*) in its "new" areas of occupation, with the exception being the hybrid *F. x bohemica.*

The primary mode of regeneration of Japanese knotweed in ecosystems to which it has been introduced is vegetative.

Yet this plant is a highly successful invader. Forming stands that can exclude other plants.

Japanese knotweed is an exceptionally wide spread clone.
(Hollingsworth and Bailey 2000)

Regeneration vigor

Newly emerged stems grow rapidly, 10 cm per day is not unusual. Crown/rhizome system provides energy source.

Energy in the crowns and the shoots can force penetration of asphalt pavements, stems and rhizomes can push between cracks in masonry and concrete.

Dense stands of Japanese knotweed

Vegetative regeneration of Japanese knotweed

Stand densities of Japanese knotweed have been estimated to be 8.9 stems/m^2 (Horn and Prach 1995), with a range of 20 to 25 (Child 1999) and a maximum count of 42 stems/m^2 (Lois Child, personal communication).

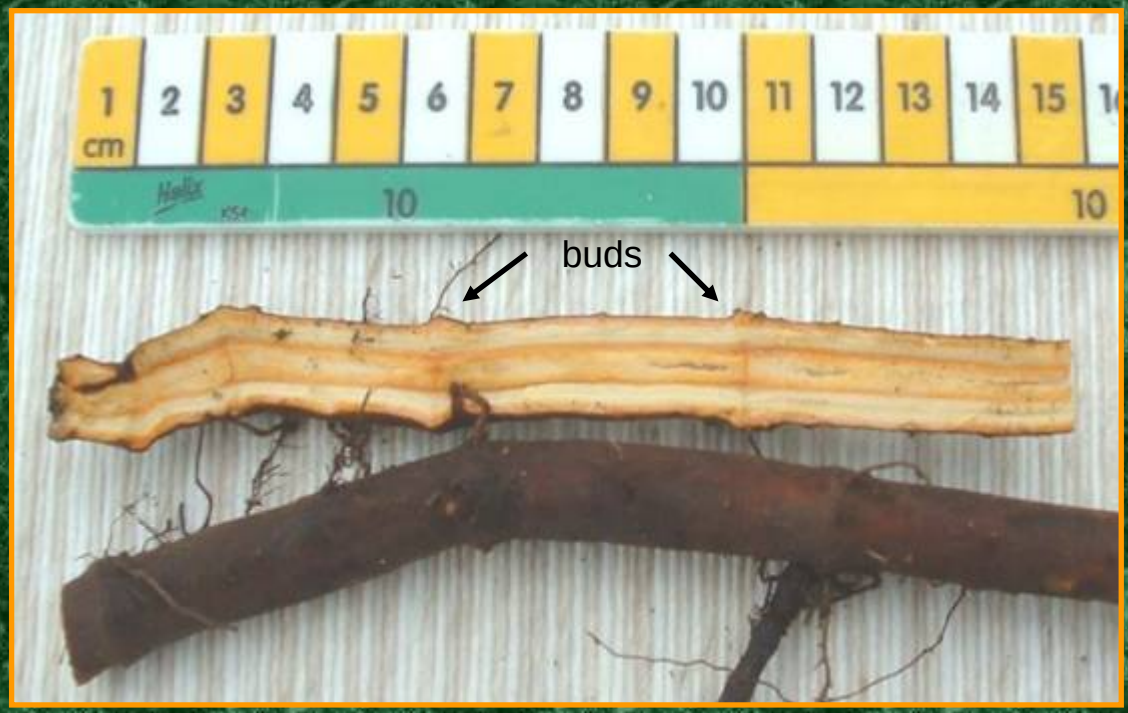
Stands of Japanese knotweed stems averaged 936.5 g/m^2 and crown and rhizomes were estimated to have a standing crop of 1,467 g/m^2 (Brock 1995).

Japanese knotweed vegetative regeneration

Three means of vegetative regeneration

1. Buds in crown tissues

2. Rhizomes



3. Nodal buds in stems

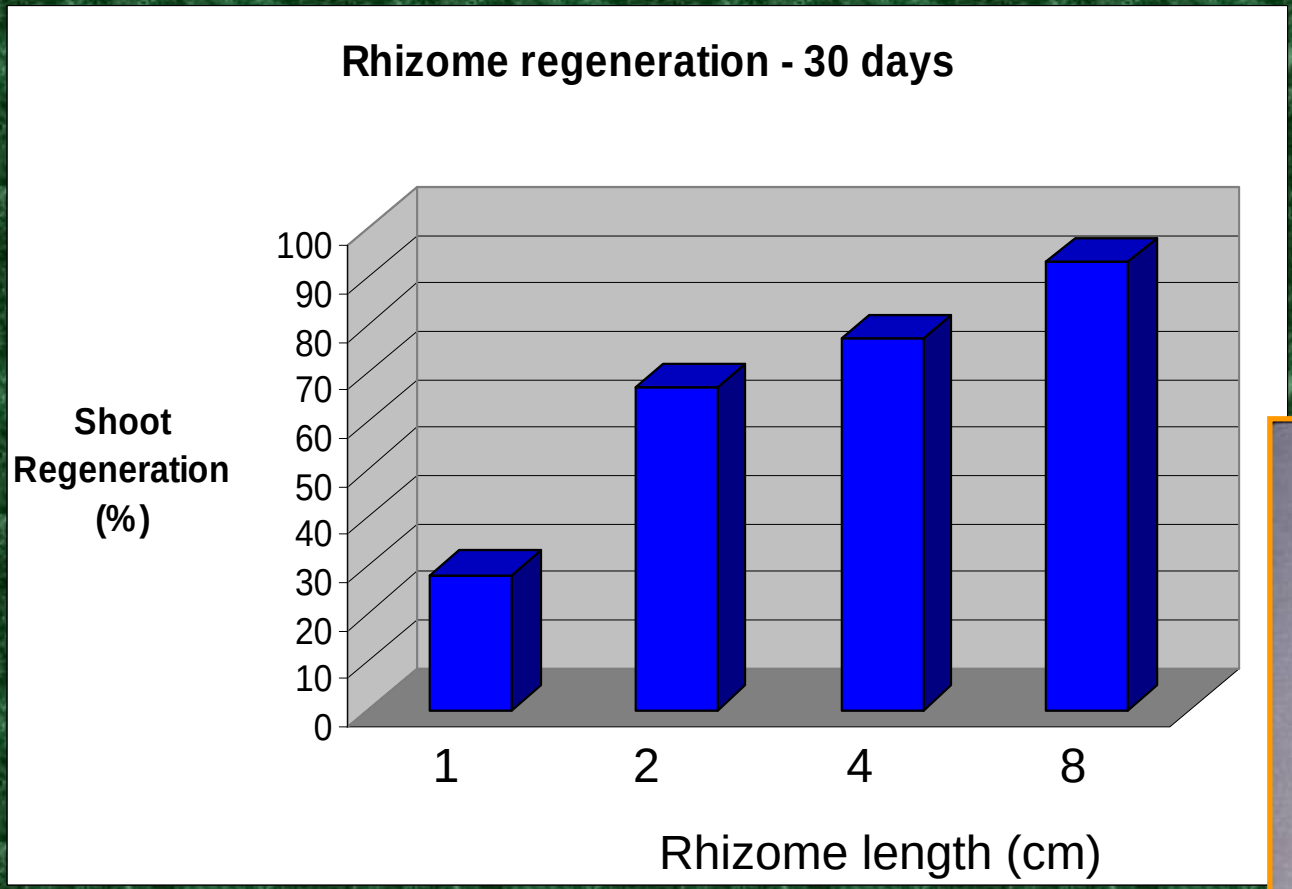
The common response is 1 shoot per node

Japanese knotweed regeneration: rhizomes

- Rhizome regeneration study
- Four lengths: 1, 2, 4, & 8 cm: N = 15 per segment length
- Mean fresh weights were 1.7, 2.4, 4.7, & 8.4 g (range 0.3 to 17.0 g)
- Overall mean weight = 4.4 g
- Smallest rhizome segment to produce a shoot = 0.7 g

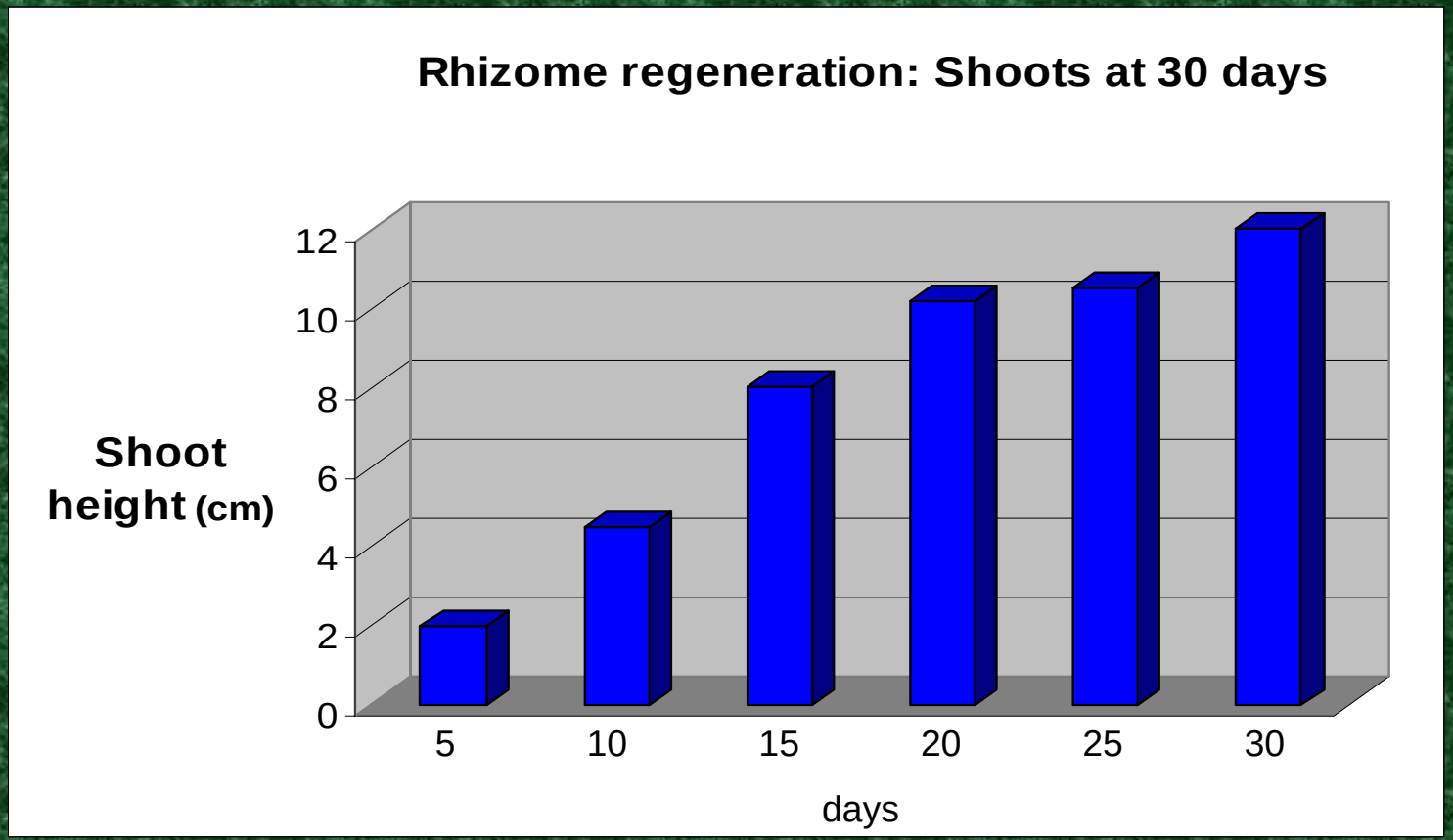
Brock and Wade (1992)

Japanese knotweed vegetative regeneration: rhizomes



Brock and Wade (1992)

Japanese knotweed vegetative regeneration: rhizomes



Brock and Wade (1992)

Japanese knotweed genotypes vegetative regeneration: rhizomes

Nine genotypes of *F. japonica X bohemica* and parental genotypes *F. japonica* and *F. sachalinensis* rhizome regeneration study in a common garden setting. Summer 2001 at Institute of Botany, Pruhonice, Czech Republic.

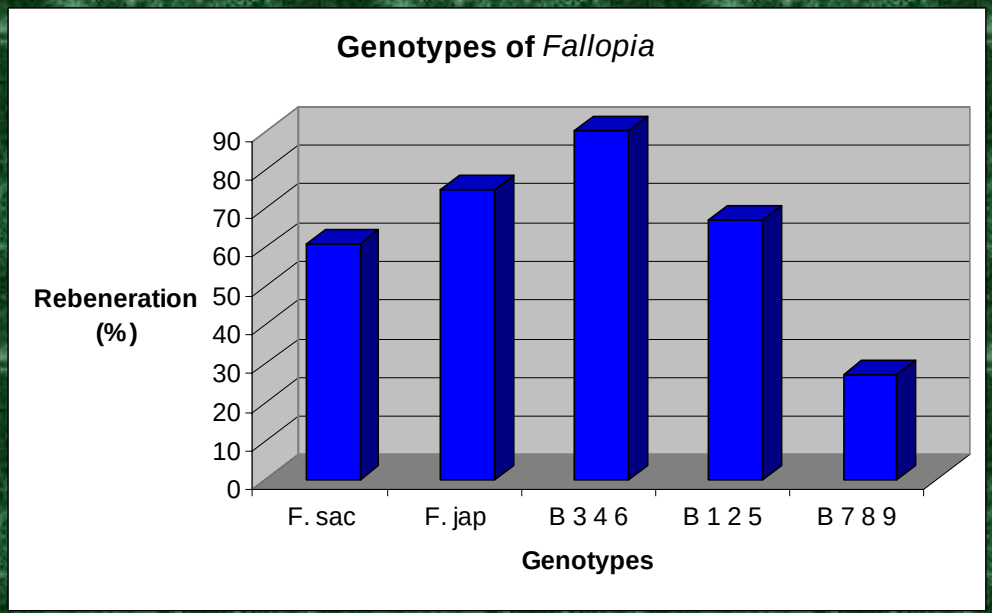
Pysek, Brock, Bimova, Mandak, Jarosik, Koukolikova, Pergl and Stepanek (2003)

Japanese knotweed vegetative regeneration: rhizomes

10 sections of rhizome from each genotype of the same clone, each with 1 node

Rhizome sections slightly pressed into potting soil

Growth monitored every 2 days or so, for regeneration to 30 days after planting.



Overall, 67 % of rhizomes regenerated

Significant effect in regeneration by *F. x bohemica*

The most invasive genotypes had the highest vegetative regeneration success

Japanese knotweed vegetative regeneration: stems

- Early 1990's hypothesis: *F. japonica* stems could potentially produce new shoots, but not documented
- Greenhouse study in 1992 at Loughborough University in UK
- 3 stem sections: lower, middle and upper
- Each section with 2 nodes
- N = 15 per section; study length for 30+ days
- 3 tests: late spring, summer and early autumn

Brock, Child, de Waal and Wade (1995)

Japanese knotweed vegetative regeneration: stems

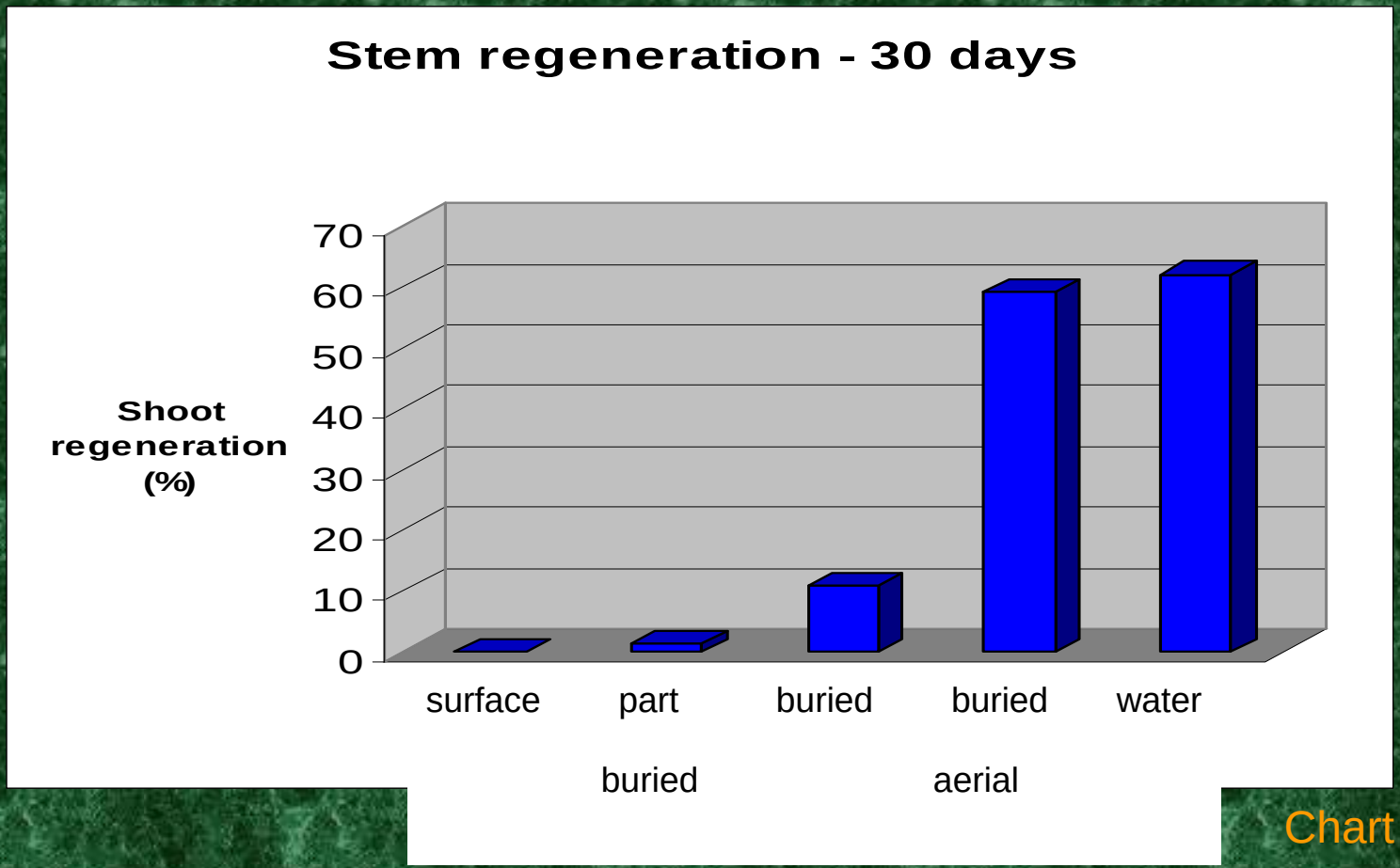
- Greenhouse stem regeneration treatments: surface, partially buried, buried, buried/aerial, water
- Stems placed in greenhouse soil mix, watered to keep moist with rain water, water treatment had water changed every 2 days to maintain freshness, ambient air temperature
- Stem sections mean characteristics:

	Length (cm)	Diameter (cm)	Fresh Weight (g)
Lower	23	1.9	54
Middle	23	1.6	35
Upper	18	1.0	13

Brock, Child, de Waal and Wade (1995)

Lower, middle and upper sections

Japanese knotweed vegetative regeneration: stems



Autumn water mean 80%

Chart data are mean of 3 seasons

Brock, Child, de Waal and Wade (1995)

Stem sections in greenhouse setting

Stem section with shoots and adventitious roots

Japanese knotweed stem dispersal in water. Material is capable of regeneration, and potential for new plant establishment.

Japanese knotweed vegetative regeneration: stems

De Waal (2001) viability of Japanese knotweed intact and split stem tissues, a greenhouse study using spring, summer and fall tissues. Split stem simulated shredded materials as used for disposal of plant materials.

- Stem regeneration study fashioned after Brock et al (1995).
- Stem tissues incubated in moist compost. Regeneration and growth observed for approximately 1 month after planting.

Viability of intact and split stems (buds/node %)

	Intact	Split
Spring	25	17
Summer	17	12
Autumn	20	9

Larger number of shoots from intact stems and from earlier in the year, but spring tissues desiccated after 3 weeks.

- Shoot height was slightly less from split stem buds, as were the number of leaves. The summer samples produced shoots up to about 71 mm, and autumn shoots had heights of 32 mm.

Vegetative regeneration of Japanese knotweed: Potential

Regeneration:

- Rhizome regeneration calculated to be 238 shoots/m^2 (Brock and Wade 1992), with smallest viable rhizome fragment and rhizome biomass (Brock 1995) the number is about 2,000 shoots/m^2 (Child 1999).
- Stem regeneration, conservatively at 2.3 shoots/m^2 (Brock et al 1995), Horn and Prach (1995) estimated 9.7, and de Waal (2001) gave a probable number of about 90 shoots/m^2 based on Brock et al 1995 information.
- de Waal (2001) estimated, based her viability data and with stand densities that regeneration potential could range from 86, to194 – 243, or to 407shoots /m^2.

Vegetative regeneration of Japanese knotweed

Japanese knotweed often spreads with human assistance. However, it could also move during flood events.

Phyto-sanitation is key to avoid new propagules of Japanese knotweed being introduced to an area.

Verify soil material is Japanese knotweed crown and rhizome free.

Dispose of Japanese knotweed cuttings after complete drying.

New technology? Irradiate it !!!

References

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Vegetative regeneration of Japanese knotweed

Thank you for your attention.

Questions / statements ???