2015 Knotweed Workshop

Closing Message on Key Workshop Findings

1. Mechanical control methods are ineffective

Many people often opt for mechanical control methods against invasive species over chemical control methods. With highly invasive and destructive species however this method of control is often not enough to eradicate the invasive plant. Knotweed in particular is not a good candidate for mechanical control. Often cutting the canes, digging out the plant or trying to pull it up will result in rhizome roots developing further or additional colonies growing from small pieces of the plant left on site. On a landscaping scale mechanical removal of knotweed does not work.

Often impractical and ineffective mechanical treatments have high labor costs and require the removal of the entire plant to yield a successful eradication. The rhizome root system can weigh anywhere between 12 and 35 tons per hectare (Rudenko, M., 2009). Trying to remove such a large mass with limited mechanical equipment, without damaging the surrounding system, can prove to be an almost impossible task. Mechanical treatment is only advised when knotweed infestations are less than 100 sq. ft. and even then can still prove to be too extensive for full mechanical treatment.

Another downfall of mechanical treatment is the timescale that it needs to be performed on to have a chance at being successful. Efforts to cut or dig out a stand of knotweed often need to be repeated throughout the year over the course of several years. It is suggested that constant mechanical control efforts need to be expended on an infestation of knotweed for approximately three to five years (Rudenko, M., 2009). Such a time frame for a method of control gives a very low cost/benefit ratio and is not worth the countless hours of work required to execute properly.

Moving forward mechanical treatment is no longer a viable option for treating invasive knotweed. The invasive plant has become far too established and widespread to be controlled with traditional mechanical treatment methods.

2. Stem injection vs. foliar spray vs. combination

Recent reports from Jeremy McClure from the Invasive Species Council of Metro Vancouver have analyzed the efficacy and economic variation between various chemical control methods. Through his study it was observed that stem injection of 5 cc of glyphosate was most effective against Japanese Knotweed with an efficacy of 97%. However the best option for treatment was deemed to be a combined treatment that utilized both stem injection (60%) and foliar spray (40%) to minimize labor and economic costs whilst maintaining a high degree of efficacy (95%) (McClure, J., 2014).

Foliar spray is considered to be the major method of chemical control for invasive knotweed species but the ISCMV study found that just applying foliar spray alone only yielded an efficacy of 77%, 3% under the commercially accepted control range (80-89%) stated in the provincial monitoring record.

Similar studies have been conducted in other parts of the world that also suffer from knotweed infestations. One such study in Belgium found that the treatment method that showed the greatest success in depleting the volume of Japanese knotweed from one year to the next, by almost 100%, was stem injection of glyphosate (Delbart, E., et.al, 2012).

The major difference between the two studies was which of the two major chemical control methods proved to be more labor intensive: stem injection or foliar spray. The ISCMV study found that stem injection was the most labor intensive method with a labor cost of 167 man-hours/ha and that foliar spray was the the least labor intensive method with a labor cost of 7 man-hours/ha (McClure, J., 2014). The Belgium study found that stem injection was the least labor intensive with a labor cost of 114 man-hours/ha and that foliar spray was the most labor intensive with a labor cost of 135 man-hours/ha. However, this discrepancy may be explained by the fact that for the foliar spray in the Belgian study the management team was dealing with very tall infestations of knotweed that required them to use ladders to spray overtop of the canes (Delbart, E., et.al, 2012). This would have significantly increased the number of man-hours per ha of knotweed for the foliar spray method. As such it can be said that labor costs can increase severely if the knotweed being treated is over a particular height restriction and that the variable of height should be considered when deciding upon the best treatment method for a site.

Overall it would appear that the chemical treatment method used for knotweed sites will be dependent on the characteristics of the sites themselves and the amount of available time/budget for the treatment of said sites. The efficacy of foliar spray may be under the commercially accepted control range listed by the province but as it is can be conducted for approximately 4% of the cost of stem injection is may still be one of the more viable methods for large-scale treatment (McClure, J., 2014). Height of the infestation will need to be regarded such that sites with canes too high for foliar spray from ground-level are treated via another method of control such as the high efficacy stem injection treatment. A combined effort of foliar spray and stem injection is recommended as the first course of action for a site of unknown nature as this treatment will provide the highest efficacy to cost (in man-hours/ha) ratio out of the three options.

3. Seed viability of Bohemian knotweed

Previously it was thought that Japanese knotweed was the most prevalent species of knotweed within North America but a recent study has found that up to 71% of knotweed plants in the USA and Canada are in fact Bohemian knotweed (Gaskin, J.F., et.al, 2014).

Bohemian knotweed is a hybrid species between Japanese knotweed and Giant knotweed and it is thought that many knotweed infestations identified as Japanese knotweed are actually Bohemian knotweed instead.

One of the leading concerns with the rampant invasion of Bohemian knotweed is the genetic diversity that is obtained by the plants thanks to a large percentage of their spread being facilitated by seed dispersal. There can be up to 2500 germinated seeds per stem of Bohemian knotweed. This method of dispersal and sexual reproduction increases the viability of the population of knotweed that produced the seeds.

Bohemian knotweed has been observed to be the most genetically diverse taxon in the North American knotweed family (Gaskin, J.F., et.al, 2014). The increased genetic variability through reproduction by seed production could, over time, lead to an increase in resilience to chemical compounds. Producing a higher resilience to the chemical compounds currently used in chemical treatment methods would lower the efficacy of said treatments and make it harder to eradicate Bohemian knotweed through chemical control.

With Bohemian knotweed propagating both vegetatively and by seed it could pose an increased threat, in comparison to other knotweed species, in the near future. As such it may be worth shifting focus to newly established patches of Bohemian knotweed to ensure that high genetic diversity colonies do not become well established in large populations that could prove too difficult to treat with current chemical control treatment methods.
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4. Biological control methods

Often once an invasive species becomes well established within a region the question of biological control methods comes up. Biological controls are seen as an ecofriendly alternative in the public's eye. What could be wrong with having nature fight nature? The issues however with biological controls is that before a species can be cleared for control it must be tested extensively to make sure that it will not have a negative effect on the native ecosystem just as the invasive species it is targeting does. Generally the process of screening, propagating, and releasing a new biological control takes between eight to ten years (Brown, B., 2015). Biological controls come with too many unknowns to look to them as the go-to answer when dealing with invasive species management.

With sufficient testing however, biological controls can work. In regards to knotweed species a psyllid species has been flagged as a potential biological control in the Pacific north-west. Host range screening for *Aphalara itadori* (sap sucker psyllid) was completed in BC in 2012. In that same year a permit to import these psyllids was submitted as well (Brown, B., 2015). This species has been flagged for the Pacific north-west because within the current distribution of knotweed seen in Canada and the US the psyllid should be able to establish well.

A study done in 2013 looked at the viability and efficacy of two separate populations of *A. itadori* in regards to knotweed species control. The study found that different populations of *A. itadori* showed different preferences and success rates on different species of knotweed (Grevstad, F., et. al, 2013). The psyllid strain from Kyushu preferentially attacked Japanese and Bohemian knotweed whilst the strain from Hokkaido showed preference for Giant knotweed specimens. A reported drop of 50% knotweed biomass in 50 days from plants subjected to the biological controls was reported from the study (Grevstad, F., et. al, 2013). It was noted that reproductive success of the psyllids might not have an effect on the efficacy of the control method, as it often does with other biological controls, as the majority of the damage to the host knotweed appeared to have occurred thanks to feeding efforts of the early instar nymph psyllids (Grevstad, F., et. al, 2013).

The psyllid species has also been flagged as a release candidate in the European Union (Shaw, R.H., et. al, 2009). Rationale behind its proposed success in this region lies in the dominance of Japanese knotweed out of the invasive knotweed species present. Japanese knotweed is believed to be clonal (Shaw, R.H., et. al, 2009). This indicates that the plant species will be unable to show variation in resistance to insect infection such as that performed by the proposed *A. itadori* control species. This same rational could be applied to the insect's potential efficacy in knotweed management here in the Pacific north-west, taking into account the different population strains for higher efficacy against the different species of knotweed present in our region.

Whether or not *A. itadori* will work as a suitable biological control for knotweed in the Pacific north-west is yet to be determined. As with any biological control the release of a foreign species to target an invasive species within a native ecosystem is never 100% risk-free. But with the proper testing and extensive monitoring the *A. itadori* populations may serve as an effective measure to help control the spread of the highly destructive invasive knotweed species.

Literature Cited

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