Canadian Food Inspection Agency

RMD-11-05 : *Taraxacum kok-saghyz* (Russian dandelion) in Canada

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Preface

As described by the International Plant Protection Convention (IPPC), Pest Risk Analysis (PRA) includes three stages: initiation, pest risk assessment and pest risk management. Initiating the PRA process involves identifying pests and pathways of concern and defining the PRA area. Pest risk assessment provides the scientific basis for the overall management of risk. Pest risk management is the process of identifying and evaluating potential mitigation measures which may be applied to reduce the identified pest risk to acceptable levels and selecting appropriate measures.

This Risk Management Document (RMD) includes a summary of the findings of a pest risk assessment and records the pest risk management process for the identified issue. It is consistent with the principles, terminology and guidelines provided in the IPPC standards for pest risk analysis.

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Executive Summary

Taraxacum kok-saghyz, commonly known as Russian dandelion, is a perennial herb of the aster family (*Asteraceae*) native to Kazakhstan, where it was discovered and first described in the early 1930s. It is similar in growth habit and appearance to the common dandelion, *Taraxacum officinale*, but is reported to be less vigorous and, when cultivated, is easily outcompeted by weeds and other crops. *Taraxacum kok-saghyz* is not currently reported to occur in the Canadian flora, nor is it known to be in cultivation here. If introduced, it is thought to have the potential to establish and spread in some parts of Canada.

Taraxacum kok-saghyz has been cultivated in the Russian Federation and elsewhere for its roots which have high rubber content. From 1941 to 1943, *Taraxacum kok-saghyz* received considerable attention as a potential alternative source of natural rubber. Plantings of *Taraxacum kok-saghyz* were initiated in several countries, including research plots across Canada and the United States (U.S.) apparently without becoming naturalized or weedy. By the end of World War II, interest in alternative rubber supplies had declined and all of the *Taraxacum kok-saghyz* plants in North America were reportedly eradicated. Renewed interest in *Taraxacum kok-saghyz* for rubber production has been evident in the U.S. in the past decade with fields established in three states. Interest from Canadian researchers has also increased. Applications have been made to import *Taraxacum kok-saghyz* into Canada to evaluate its potential as a field crop, and controlled environment research trials are currently being conducted with this species in Ontario and Quebec.

While there is potential for the cultivation of *Taraxacum kok-saghyz* to result in the introduction and spread of the species in Canada, the economic and environmental impacts associated with this are anticipated to be low. A number of risk mitigation scenarios have been considered and are outlined in this document. The disadvantages of requiring risk mitigation measures are deemed to outweigh the potential advantages of developing this species as a commercial crop. Following stakeholder consultation, the Canadian Food Inspection Agency has decided not to regulate *Taraxacum kok-saghyz* as a pest for Canada.

1.0 Purpose

To record the final risk management decision with regard to regulation of *Taraxacum kok-saghyz*.

2.0 Scope

This Risk Management Decision Document summarizes the Canadian Food Inspection Agency's (CFIA) decision not to regulate *Taraxacum kok-saghyz* as a pest for Canada.

Information pertaining to current import requirements for specific plants or plant products may be obtained from the CFIA **Automated Import Reference System**.

Additional points for consideration:

1. Prior to use as human food, new plants and/or derived products that fit the definition of a novel food require approval under the authority of the *Food and Drugs Act* from Health Canada.

2. Prior to use as livestock feed, new plants and/or derived products must be assessed and approved by the Animal Feed Division, CFIA under the authority of the *Feeds Act* and *Regulations*. A positive list of approved ingredients can be found in Schedules IV and V of the *Feeds Regulations, 1983*.
3. Release (e.g. cultivation) of plants with novel traits into the Canadian environment may require prior approval under the authority of the *Seeds Act* and the *Seeds Regulations* from the Field Crops Division, CFIA.
4. The importation and sale of seed in Canada must meet the requirements of the *Seeds Act, Seeds Regulations* and *Weed Seeds Order*. Seed for propagation sold, imported into or exported from Canada must conform to the *Seeds Act* and *Regulations*, including seed of *Taraxacum kok-saghyz*.
5. All imported material must meet phytosanitary requirements for all applicable regulated organisms, as stated in CFIA's **Plant Protection Policies and Directives**.

3.0 Definitions

Definitions for terms used in this document can be found in the **Plant Health Glossary of Terms** or the **IPPC Glossary of Phytosanitary Terms**.

4.0 Background

- Invasive plants are those plant species that spread when introduced outside of their natural past or present distribution and cause serious and often irreversible damage to Canada's ecosystems, economy and society.
- The CFIA prevents the introduction of invasive plants and weeds into Canada under the authorities of the *Plant Protection Act* and the *Seeds Act*.
- A quarantine pest is a pest of potential economic importance, not yet present in Canada or present but not widely distributed and being officially controlled.

The CFIA is evaluating and, where appropriate, restricting the importation and spread of invasive plants as part of its mandate to protect Canada's plant resource base and its commitment to limit the introduction and spread of invasive plants under *An Invasive Alien Species Strategy for Canada* (Government of Canada, 2004). The Strategy aims to reduce the risk of invasive species to the environment, economy, and society, and to protect environmental values such as biodiversity and sustainability.

Applications to import *Taraxacum kok-saghyz* into Canada have been made and controlled environment research trials are currently being conducted with this species. There is interest in evaluating *Taraxacum kok-saghyz* as a field crop for Canada.

4.1 Identity of Organism

Name: *Taraxacum kok-saghyz* L. E. Rodin (*Asteraceae*) (USDA-ARS 2010)

Synonyms: *Taraxacum brevicorniculatum* Korol.

Common names: Kok-saghyz, Russian dandelion (USDA-ARS 2010)

French common name: pissenlit de Russie

Taraxacum kok-saghyz is a perennial (grown as an annual or biennial in cultivation) herb with a fleshy taproot, decumbent leaves in a basal rosette, and solitary yellow flower heads borne on hollow leafless scapes (stalks). It is similar to the common dandelion, *Taraxacum officinale* F. H. Wigg aggr., differing in its leaves (fleshy, bluish-green with a glossy surface, and without small teeth on their margins), flower heads (smaller), and involucral bracts (not reflexed and with well-developed hornlike appendages) (Artschwager and McGuire 1943; Krotkov 1945; Bailey and Bailey 1976). It has been

cultivated in the Russian Federation and elsewhere for its roots which have high rubber content (Bailey and Bailey 1976; Holm et al. 1977). However, only limited breeding has been carried out, and the plant is still represented essentially by its wild forms (Krotkov 1945; Bonner and Galston 1947; Bailey and Bailey 1976; Holm et al. 1977; Lazarides and Hince 1993; van Beilen and Poirier 2007).

4.2 Presence / Absence in Canada

Taraxacum kok-saghyz is not reported to occur either in the Canadian flora (Scoggan 1979; Flora Of North America Editorial Committee 1993+; Kartesz 1999; CFIA 2008), or in naturalized populations in the U.S. (Flora Of North America Editorial Committee 1993+; Kartesz 1999; USDA-NRCS 2010).

Some *Taraxacum* species are occasionally grown as ornamentals (Bailey and Bailey 1976), but no evidence was found to indicate that *Taraxacum kok-saghyz* is used for that purpose (e.g., Isaacson and Allen 2007; CNLA 2008; COPF 2008). It has been cultivated for rubber production, in Russia from about 1930-50, and in several European countries for emergency rubber programs during World War II (van Beilen and Poirier 2007). Trials were also conducted in the U.S. and Canada during that time (1940s) (Krotkov 1945), and in Australia (Lazarides and Hince 1993) and New Zealand (Bonner and Galston 1947). Plantings of *Taraxacum kok-saghyz* were initiated in research plots across Canada and the U.S. In the U.S., plantings were made on 207 soil types in 161 localities in 41 States (Whaley, 1947). All these programs were reportedly terminated after the war and all the plants were reportedly eradicated (van Beilen and Poirier 2007, Whaley, 1947). More recently, renewed interest in *Taraxacum kok-saghyz* for rubber production is evident in the U.S., with test plots established in three states. Canadian researchers are also interested in evaluating *Taraxacum kok-saghyz*, and limited research trials have recently been initiated in Ontario and Quebec. No other evidence was found of current cultivation in Canada.

Based on this information, *Taraxacum kok-saghyz* is considered "present: only in protected cultivation" in Canada.

4.3 Current Regulatory Status

Taraxacum kok-saghyz is not currently regulated as a pest in Canada, either federally or provincially. It is not regulated as a federal noxious weed in the U.S., and is not regulated in any U.S. states (although *Taraxacum* spp. are regulated in Alaska) (Rice 1997-2008).

5.0 Pest Risk Assessment

The information in this section is taken from the pest risk assessment (PRA# 2009-41 (Revised)) conducted by C. Wilson, Plant and Biotechnology Risk Assessment Unit (CFIA, 2010). The risk assessment summarizes the available information on *Taraxacum kok-saghyz* and evaluates the probability of entry, establishment, and spread in Canada, and the potential economic and environmental consequences. The factors considered in each of these sections, along with the guidelines used to assign risk and uncertainty ratings, are shown in **Appendix 1**. Overall risk and uncertainty is summarized in terms of probability and consequences.

5.1 Probability of Entry

The most likely pathway of entry of *Taraxacum kok-saghyz* into Canada is intentional importation. An application for a permit has already been received, to import the species into Canada for the evaluation of its rubber properties.

It is also possible *Taraxacum kok-saghyz* could move as a seed contaminant. Two sources indicate this (Wiersema and León 1999; USDA-ARS 2010), but the reports are questionable. In the first (Wiersema and León 1999), the designation "potential seed contaminant" is based on the inclusion of *Taraxacum kok-saghyz* in the Association of Official Seed Analysts (AOSA) Handbook 25 (*Uniform Classification of Crop and Weed Seeds*). However, this list includes plants that are important both as intended and unintended components of commercial seed (i.e., crops and weeds). Inclusion on the list simply indicates that seed of the species has moved in commerce at some point, either as a commodity or a

contaminant. In the case of *Taraxacum kok-saghyz*, its widespread cultivation for rubber suggests the possibility that it was included as a crop seed rather than a commodity contaminant.

In the second source (USDA-ARS 2010), *Taraxacum kok-saghyz* is reported as a "weed: also potential seed contaminant", referenced to the CSIRO Handbook of Economic Plants of Australia (Lazarides and Hince 1993). The original source reads "cultivated in Tasmania during World War II", and gives "use" as "crop, weed" (Lazarides and Hince 1993). This suggests the species escaped cultivation and naturalized in Tasmania, which is supported by other sources (e.g., Randall 2002; Australian National Botanic Gardens 2009). However, it does not necessarily indicate that it is a seed contaminant. No further evidence was found to indicate that *Taraxacum kok-saghyz* has moved unintentionally in trade, as a contaminant of agricultural products or machinery.

Risk Rating for Probability of Entry: Probability of entry is automatically assigned a rating of "**high**" because the primary pathway of introduction is the intentional importation of plants for planting[1].

Uncertainty and Information Gaps: Uncertainty is considered "**negligible**"; applications for permits to import have been received, and limited research trials are already underway in Ontario and Quebec. There is some uncertainty around some of the other, less likely, potential pathways of entry. For example, there is uncertainty around whether *Taraxacum kok-saghyz* has been found as a seed contaminant, or whether references to this in the literature are spurious. There is also the possibility that *Taraxacum kok-saghyz* could be introduced along other pathways, such as by wind, water or wildlife, or on motorized vehicles or farm equipment. No evidence was found to suggest this in the literature, but related species are reported to disperse along these pathways.

5.2 Probability of Establishment

Taraxacum kok-saghyz is native to Kazakhstan, where it was discovered and first described in the early 1930s from populations in the valleys of the Tien Shan mountains (between 79°-80°30' E longitude and 42°20'-43°20'N latitude). The elevation in this region ranges from 1800-2000m above sea level, and the climate is continental (Krotkov 1945; Bonner and Galston 1947). *Taraxacum kok-saghyz* is also reported as native in bordering areas of western China (Flora of China Editorial Committee 1959+; USDA-ARS 2010) and Kyrgyzstan (USDA-ARS 2010). It is naturalized elsewhere (USDA-ARS 2010), as in Europe, where it was cultivated and now occurs locally in Austria, Czechoslovakia, Germany, Hungary, Romania, and western Russia (Tutin et al. 1976), and in Australia where it occurs in Tasmania (Lazarides and Hince 1993; Australian National Botanic Gardens 2009). It is not known in North America outside cultivation (Flora Of North America Editorial Committee 1993+; Kartesz 1999; USDA-ARS 2010). Based on this distribution, *Taraxacum kok-saghyz* appears to survive at least up to **NAPPFAST plant hardiness zone 5**. More details about records in Europe and Asia could extend this.

In its native range, *Taraxacum kok-saghyz* is reported to occur in riverside terraces, meadows, and fields (Flora of China Editorial Committee 1959+). It grows on a wide range of soil conditions, although it prefers soils with an average to low salt content, large amounts of humus and high moisture. It often invades cultivated fields, where it thrives and grows luxuriantly (Krotkov 1945). Outside of its native range, it occurs primarily in cultivation. It is described as highly adaptable, although it is a temperate zone species and does poorly in warmer climates (Whaley 1944; Bonner and Galston 1947). It requires rich, not too heavy soil, and does best on peat and muck; although it does not like an acid medium, so such soils must be heavily limed (Krotkov 1945).

Based on its native distribution and available records, it appears that *Taraxacum kok-saghyz* would find climatic and ecological conditions suitable for establishment and spread in at least some parts of the PRA area (e.g., plant hardiness zones 5-9, in southern and coastal B.C., southern Ontario and the Atlantic coast).

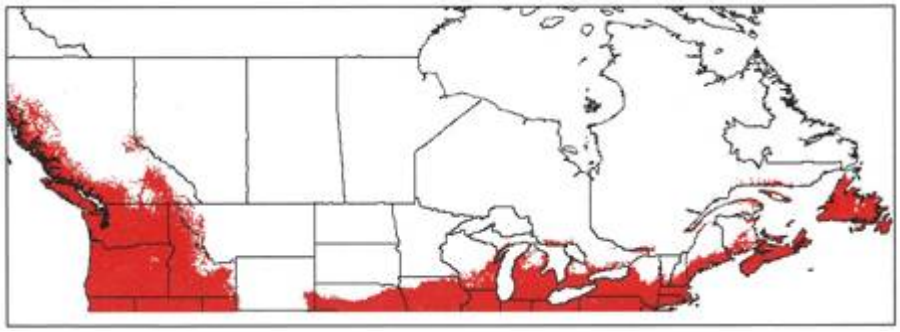

Figure 1. Potential Range of *Taraxacum kok-saghyz* in Canada (NAPPFAST zones 5-9)

Risk Rating for Probability of Establishment: Probability of establishment is rated "**medium**" for *Taraxacum kok-saghyz*, as it has the potential to survive and become established in at least 4-5 Plant Hardiness Zones in Canada (e.g. the area up to and including NAPPFAST zone 5).

Uncertainty and Information Gaps: Uncertainty is considered "**low**" as there is direct evidence from reliable sources that *Taraxacum kok-saghyz* can establish in Canada. There is some question about the extent to which it could establish, and further investigation of its cultivation and distribution in Europe and Asia could help refine the estimated potential range in Canada. For example, Bonner and Galston (1947) report that it has been cultivated as far north as Archangel in northwestern Russia. If it is able to survive outdoors without protection in that climate, its potential range in Canada would be significantly extended.

5.3 Probability of Spread

Taraxacum kok-saghyz reproduces and disperses naturally by seed. Although naturally a perennial, it may be grown commercially as an annual or biennial. In the first year of growth, plants may begin to flower 60-70 days from the time of sowing (Krotkov 1945). It is primarily an out-crossing species, pollinated by bees (*Halictus, Apis*), although occasional cases of self-pollination have been reported. Normal plants are self-sterile and cross-fertile in summer, but some self-fertility is manifested in late fall and winter (Borthwick et al. 1943; Warmke 1943; Krotkov 1945; Bonner and Galston 1947). In its native habitat, pollination is mainly carried out by the burrowing bee (*Halictus*), while under the conditions of cultivation it is effected by honey bees (*Apis mellifera*) (Krotkov 1945). Fruits are small achenes, each with a white, feathery pappus that facilitates wind dispersal (Artschwager and McGuire 1943; Krotkov 1945). Average seed weight is 3000 seeds/g (Krotkov 1945) and the greatest yield of seeds from a two-year old plantation has been reported as 215 kg/hectare [=21.5g/m^2] (Krotkov 1945). No evidence was found for vegetative reproduction (e.g., see discussion in Whaley 1944).

Natural dispersal of seeds is primarily by wind (Artschwager and McGuire 1943; Krotkov 1945), and though dispersal distances are not reported for *Taraxacum kok-saghyz*, seeds of the related *Taraxacum officinale* are reported to travel up to 500m (CAB International 2007). No reports of other natural dispersal mechanisms were found for *Taraxacum kok-saghyz*. However, seeds of *Taraxacum officinale* are also dispersed by water (especially irrigation ditches), and can germinate from the feces of wildlife (e.g., white-tailed deer), livestock (e.g., cattle, horses), and birds (CAB International 2007).

Hybridization may also contribute to natural spread. The genus is noted for its taxonomic complexity, associated with a wide range of ploidy levels and breeding systems. Most taxa (including the common dandelion, *Taraxacum officinale*) are polyploid and reproduce by agamospermy (apomixis), while others, including *Taraxacum kok-saghyz*, are diploid and reproduce sexually (Whaley 1944; Shibaike et al. 2002). Despite the different breeding systems exhibited in *Taraxacum*, recent studies have shown gene flow between diploid sexual and triploid asexual populations, indicating that they are less genetically isolated than formerly supposed (King 1993, Brock 2004, Shibaike et al. 2002). At least one study suggests that natural hybrids between *Taraxacum kok-saghyz* and *Taraxacum officinale* do occur, although the hybrids were male sterile (Malecka 1971). Based on the evidence presented for the genus (Richards 1970, Watanabe et al. 1997, Morita et al. 1990, Shibaike et al. 2002) it would seem possible that the sexual diploid *T. kok-saghyz* could hybridize either with other sexual diploid species or with polyploid agamic species (the latter representing most species in the Canadian flora). Thus, there is the

possibility that *T. kok-saghyz* will hybridize with introduced weedy dandelions (e.g., *T. officinale*). From the literature it would appear that the most likely outcome of this hybridization would be the genetic assimilation of *T. kok-saghyz* into the *T. officinale* complex rather than the other way around.

Human-mediated spread may occur in several ways. Intentional movement of seed or plants for cultivation is the most obvious, and in the past this has resulted in the introduction of *Taraxacum kok-saghyz* outside its natural range in Russia, several European countries, North America, New Zealand and Australia (Bonner and Galston 1947; Lazarides and Hince 1993; van Beilen and Poirier 2007). However, this does not present a weed threat unless the species escapes cultivation and establishes elsewhere. This is only reported to have occurred in Europe, where it is locally naturalized (Tutin et al. 1976). It is possible that *Taraxacum kok-saghyz* could also move as a seed contaminant, or with motorized vehicles or farm machinery, however there is limited evidence of this in the literature (see above) (pathways for entry of the plant into Canada are also potential pathways of movement within the country).

Note that *Taraxacum kok-saghyz* is very similar in appearance to the widespread common dandelion, *Taraxacum officinale*, which might inhibit identification and early detection if it were to spread outside cultivation in Canada.

Risk Rating for Probability of Spread: Probability of spread is considered "**medium**" for *Taraxacum kok-saghyz*, as it has high reproductive potential (~64,500 seeds/m^2) but only moderate mobility of propagules (~500m by wind if comparable to *Taraxacum officinale*).

Uncertainty and Information Gaps: Uncertainty is considered "**medium**", as there is evidence that *Taraxacum kok-saghyz* could spread in Canada, but significant uncertainty as to the rate and extent of spread, and whether it would escape cultivation. There is very limited information available on natural dispersal mechanisms; it is clear that wind is the primary means of dispersal, but not clear whether (or how far) seeds might also be dispersed by water, birds and animals (as in the case of *Taraxacum officinale*). Further information on hybridization potential would help determine if this is a significant risk in Canada. Further information on the behaviour of *Taraxacum kok-saghyz* in naturalized populations in Europe and Asia would also be helpful in clarifying its spread potential.

5.4 Potential Economic and Environmental Consequences

In its native range, *Taraxacum kok-saghyz* is a minor agricultural weed, invading cultivated fields, where it thrives and grows luxuriantly (Krotkov 1945). It has also become naturalized where it was cultivated in Europe (Tutin et al. 1976), and Australia (Lazarides and Hince 1993; Australian National Botanic Gardens 2009). It is not listed in most of the major invasive species references and/or databases of the world (Holm et al. 1977; Hanf 1983; Holm et al. 1991; Holm et al. 1997; Parsons and Cuthbertson 2001; Weber 2003; CAB International 2007; Global Invasive Species Database 2008). Its inclusion in *A Global Compendium of Weeds* (Randall 2002, 2007) appears to be based primarily on its presence as a naturalized species in Europe and Australia. In Canada and the U.S., it was historically cultivated for rubber production (Krotkov 1945), apparently without becoming naturalized or weedy (e.g., Flora Of North America Editorial Committee 1993+). It is reported to be less vigorous than common dandelion, and easily out-competed by weeds and other crops in cultivation (Whaley and Bowen 1947; van Beilen and Poirier 2007). No references were found to indicate economic costs (e.g., crop losses, weed control).

Although *Taraxacum kok-saghyz* has naturalized outside of cultivation in Europe and Australia, it is not reported as a weed of gardens or disturbed areas, nor is it reported as an invasive plant or environmental weed of natural areas. *Taraxacum kok-saghyz* is not reported to be allelopathic, or toxic to animals or people. It does not produce spines, burrs, or any other appendages that might make it undesirable or interfere with recreational or other human activities. However, at least one other similar *Taraxacum* species (*Taraxacum officinale*) is a serious/principal weed in many parts of the world (Holm et al. 1991), and several other species are listed as weeds by other sources (e.g., Reed 1977; Randall 2002; Darbyshire 2003). This is primarily due to their high reproductive potential and ability to adapt to a wide range of conditions, particularly affecting the aesthetics of turf and lawn systems and competing with agricultural and horticultural crops (CAB International 2007).

If it were introduced to Canada it is possible that *Taraxacum kok-saghyz* could have similar impacts to those of *Taraxacum officinale*. However, it is reported to be less vigorous, and if the two species occupy a similar niche or habitat, the additional impacts may be insignificant. This is speculative, and not discussed in the literature. It is also possible that *Taraxacum kok-saghyz* could hybridize with other *Taraxacum* species and have an environmental impact by affecting those populations, or becoming weedier itself. At least one study suggests that natural hybrids between *Taraxacum kok-saghyz* and *Taraxacum officinale* do occur, although the hybrids were male sterile (Malecka 1971; see above).

Risk Rating for Potential Economic and Environmental Consequences: Potential economic and environmental consequences are rated "**low**" for *Taraxacum kok-saghyz*, as it appears to have limited potential to cause economic impacts or affect the environment in Canada, based on information from areas where it currently occurs.

Uncertainty and Information Gaps: Uncertainty is considered "**medium**" as the risk rating is based primarily on a lack of evidence that *Taraxacum kok-saghyz* has become a significant weed in areas where it has been cultivated. More research on naturalized populations in Europe and Australia might help to clarify its impacts where it has escaped and established outside cultivation. Further information on hybridization potential would also help determine if this is a significant risk in Canada. However, the lack of references to its weediness in other countries, and the lack of references to presence or weediness in North America after its widespread cultivation here, both support the suggestion that for unimproved forms at least, potential impacts are minimal.

5.5 Summary

The following table summarises the risk and uncertainty ratings for *Taraxacum kok-saghyz*, assigned in each section of the risk assessment, above. The overall probability of introduction and spread, and associated uncertainty rating, were calculated following the guidance in **Appendix 1**.

Table 1. Summary of Risk Assessment and Uncertainty Ratings for *Taraxacum kok-saghyz*

Probability	Risk Rating	Uncertainty
Probability of Entry	High	Negligible
Probability of Establishment	Medium	Low
Probability of Spread	Medium	Medium
Overall Probability of Introduction and Spread	Medium	Low

Consequences	Risk Rating	Uncertainty
Potential Economic and Environmental Consequences	Low	Medium

5.6 Conclusion

The evidence examined in this risk assessment suggests that *Taraxacum kok-saghyz* has the potential to escape cultivation, establish, and spread in parts of Canada, particularly parts of British Columbia, southern Ontario and the Atlantic Provinces and possibly others. However, its potential economic and environmental consequences appear to be low. It is reported as a minor agricultural weed in its native range, but is not reported as a weed in areas where it has escaped cultivation and formed locally naturalized populations. It is generally described as a poor competitor with other plant species, and extensive cultivation trials in the U.S. and Canada during World War II have not resulted in any known escapes. This could change if breeding programs produced more competitive varieties. It is also possible that *Taraxacum kok-saghyz* could hybridize with other native and introduced *Taraxacum* species in Canada; however the impacts of this are unclear.

5.7 Technical Issues for Consideration

Taraxacum kok-saghyz looks very similar to the common dandelion, *Taraxacum officinale* F. H. Wigg aggr., which could pose a challenge for early detection if it were to escape from cultivation in Canada. *Taraxacum kok-saghyz* can be distinguished by its leaves, which are fleshy, bluish green with a glossy surface, and without small teeth on their margins. However, leaves show considerable polymorphism and may also sometimes be not so deeply lobed (often nearly entire). *Taraxacum kok-saghyz* has smaller flower heads than *Taraxacum officinale*, and involucral bracts that are not reflexed and have well-developed hornlike appendages (Artschwager and McGuire 1943; Krotkov 1945; Bailey and Bailey 1976). Identification should be possible with expert advice, but may be difficult in the field.

Consultation with the CFIA seed lab has indicated that they do have specimens in the National Seed Herbarium and, although seeds of *Taraxacum kok-saghyz* look very similar to seeds of *Taraxacum officinale*, they are distinguishable with good reference specimens, magnification and reference material/training. Seeds of both species are a similar shape, the same colour, and have common features such as pronounced teeth and a long spike at the top of the achene.

6.0 Risk Management

6.1 Introduction

In this section, potential risk mitigation measures are provided for each pathway type outlined in **Section 5.1**. The effectiveness and feasibility of those mitigation measures are discussed including impacts on the CFIA, practicality of implementation, impacts on Canadian stakeholders, impacts on trade relationships, and short-term and long-term sustainability.

This document summarizes the rationale in determining the regulatory status of *Taraxacum kok-saghyz*. It outlines the possible phytosanitary requirements for traded commodities. The commodities may be the plant under consideration for regulation itself (intentional introduction) or a product contaminated with the plant (unintentional introduction).

6.2 International Responsibilities, Government of Canada Priorities and CFIA Objectives

Canada is a contracting party to the International Plant Protection Convention (IPPC), and is a member of the World Trade Organization (WTO). The IPPC is formally identified in the WTO Sanitary and Phytosanitary (SPS) Agreement as the international standard setting organization for phytosanitary measures. The IPPC is an international treaty to secure action to prevent the spread and introduction of pests of plants and plant products (including plants as pests), and to promote appropriate measures for their control.

The CFIA is recognized under the IPPC as Canada's official National Plant Protection Organization. The CFIA is correspondingly invested with a number of responsibilities set out in the IPPC, and plays an important role in protecting Canada's plant resource base from pests and diseases. In that regard, the objectives of the CFIA's plant protection program are to: (1) prevent the introduction and spread within Canada of plant pests of quarantine significance, including invasive plants; (2) detect and control or eradicate designated plant pests in Canada; and (3) certify plants and plant products for domestic and export trade.

In 1996, as a party to the United Nations Convention on Biological Diversity (CBD), Canada developed the Canadian Biodiversity Strategy, which recognized the need to conserve biological diversity and promote the sustainable use of biological resources through increased understanding, legislation, incentives and other means. In addition, in September 2004 Canada introduced *An Invasive Alien Species Strategy for Canada*, aimed to minimize the risk of IAS to the environment, economy, and society, and to protect environmental values such as biodiversity and sustainability. The CFIA provides leadership in the implementation of the national IAS strategy as it relates to invasive plants and plant pests.

As party to these international and national instruments, Canada has a strong commitment to addressing the deleterious impacts of invasive plants.

6.3 Values at Risk

Risk assessment anticipates the impact to the Canadian economy and environment from introduction of *Taraxacum kok-saghyz* to be low. *Taraxacum kok-saghyz* is not known to be regulated as a quarantine pest in other parts of the world. Therefore, trade impacts are not anticipated as a result of it being imported, cultivated as a crop or potentially becoming established in some parts of Canada.

Taraxacum kok-saghyz is anticipated to have the potential to establish and spread in some areas of Canada (NAPPFAST zones 5-9); areas of Canada in which common dandelion, *Taraxacum officinale* is already well established. A number of the asexual polyploids occur as weeds throughout much of the world (e.g. *T. officinale*); by contrast most sexual diploids (e.g. *T. kok-saghyz*) are localized species of semi-natural habitats and are rarely weedy (CAB International 2007). *Taraxacum officinale* is widely distributed in the U.S. and Canada occuring in all states, provinces and territories and has been identified from almost all isolated regions of Canada (Stewart-Wade et al. 2002). Where the hardiness zones overlap, (e.g. NAPPFAST zones 5-9) *Taraxacum kok-saghyz* would likely inhabit some of the same or similar niches as *Taraxacum officinale*. While *Taraxacum kok-saghyz* and *T. officinale* have different breeding systems, should hybridization occur the literature suggests that the most likely outcome of this hybridization would be the genetic assimilation of *T. kok-saghyz* into the *T. officinale* complex rather than the other way around. Additional impacts above and beyond those already felt by *Taraxacum officinale* are expected to be low.

Taraxacum kok-saghyz is reported to be a weak competitor with other plants in cultivation, and is readily suppressed even when it is well established (Whaley 1947). In attempts to domesticate this wild plant in the U.S., numerous fears were expressed that the plant might become a noxious weed. In many cases the fields were plowed and disked, and this was sufficient to eradicate *Taraxacum kok-saghyz*. In fields where a few *Taraxacum kok-saghyz* still remained, the newly planted crops, such as wheat, would outgrow and completely suppress any standing *Taraxacum kok-saghyz* (Whaley 1947).

Taraxacum kok-saghyz has been introduced to North America on several occasions, field trials were widespread in both the U.S. and Canada during WWII. The United States is again pursuing the use of *Taraxacum kok-saghyz* as a strategic resource and have begun cultivating this species in three states. These fields are within several hundred kilometres of the Canadian border.

There is limited information on instances where *Taraxacum kok-saghyz* has been found as a contaminant of imported commodities. However, common dandelion (*Taraxacum officinale*) has been found as a contaminant in the following imports: forage mixtures, lawn grass mixtures, ground cover mixtures, fescues, Canada bluegrass, Kentucky bluegrass, and timothy (correspondence with CFIA seed lab, 2010). For each of the years 2006 - 2008, approximately 1.7 million dollars of seed of the aforementioned crops were imported into Canada from areas known to be infested with *Taraxacum kok-saghyz* (Statistics Canada, 2009). *Taraxacum officinale* has a global distribution (Stewart-Wade, 2002) therefore, these same areas and likely these same crops would be infested with *Taraxacum officinale*; differentiation between these two species would prove difficult.

Taraxacum species have been used medicinally for centuries to treat a myriad of conditions. No references were found that specifically refer to medicinal properties of *Taraxacum kok-saghyz* (including a search of agricultural and other scientific databases such as Agricola, Agris, Biological Abstracts, CAB Abstracts, Foodline Science, Food Science and Technology, and Medline, 1970s to present). However, it is used as an edible plant in its native range, where "kok-saghyz" means "green chew", since it is used by the local population as a masticatory (Krotkov 1945). A few websites also promote *Taraxacum kok-saghyz* as a natural herb, with many of the same culinary uses described as for *T. officinale* (i.e. **edible leaves, leaves for tea, roasted roots as coffee substitute**) (e.g., **Plants for a Future**).

Taraxacum kok-saghyz has been identified as a potential alternative source of natural rubber. All natural rubber currently used in Canada is imported; it can be extracted from a variety of plant species, but the most significant source is the rubber tree (*Hevea brasiliensis*) with the vast majority of

production occuring in Asia. (Industry Canada, 2011). From 2005 to 2009, Canadian imports of natural rubber were valued at approximately 1.5 billion dollars (Statistics Canada). Interest in developing an alternative natural rubber source is growing. Regulating *Taraxacum kok-saghyz* as a quarantine pest may limit innovation and put Canada at a disadvantage in developing an alternative source for natural rubber, as it would limit or eliminate the potential to investigate and develop this species as a crop in Canada.

Crop diversification is widely promoted by federal and provincial agricultural agencies throughout Canda and the addition of *Taraxacum kok-saghyz* as a potentially profitable crop in Canada would further this goal.

6.4 Risk Mitigation and Pathways of Introduction

The following section addresses each potential pathway of introduction for *Taraxacum kok-saghyz* and presents potential mitigation options.

6.4.1 Introduction to Canada by Natural Dispersal

The closest established test plots of *Taraxacum kok-saghyz* to Canada are located in Ohio and Oregon. The current locations are considered to be outside the range for wind dispersal of seeds onto Canadian soil thus, this pathway of introduction is considered unlikely at this time. Furthermore, natural means of dispersal by animals, wind or through hybridization and subsequent wind dispersal is not feasible to control via regulatory mechanisms therefore no risk mitigation measures have been outlined for this pathway.

6.4.2 Introduction by Intentional Importation - Seed

This is considered the most likely pathway of introduction due to the interest in *Taraxacum kok-saghyz* as a commercial crop. There are research trials currently taking place in Ontario and Quebec. While a risk management decision is being made, the CFIA has imposed conditions on importation and growth to prevent environmental release.

Potential Risk Mitigation Measures for Intentional Importation

Regulate *Taraxacum kok-saghyz* as a quarantine pest under the *Plant Protection Act* and add this species to the *List of Pests Regulated by Canada* (CFIA, 2009) in order to:

- prevent the importation, movement, and cultivation of this species in Canada.
- enable inspectors to take appropriate action for the purposes of eradicating the pest or preventing its spread.

Seed would be refused entry into Canada as such permits to import seed of *Taraxacum kok-saghyz* would not be issued[2].

Trade Implications

None anticipated.

Cost-effectiveness and Feasibility

The CFIA has existing measures in place to prevent the intentional introduction of quarantine pests.

6.4.3 Introduction by Non-intentional Importation Pathways

The risk assessment for *Taraxacum kok-saghyz* indicated that non-intentional introduction was unlikely, therefore risk mitigation measures for specific pathways have not been identified. However, under the *Plant Protection Regulations*, imported commodities must be free from species on the *List of Pests Regulated by Canada*.

Potential Risk Mitigation Measures for Non-intentional Importation Pathways

Regulate *Taraxacum kok-saghyz* as a quarantine pest under the Plant Protection Act and add this species to the *List of Pests Regulated by Canada* (CFIA, 2009) in order to:

- prevent the importation, movement, and cultivation of this species in Canada.
- enable inspectors to take appropriate action for the purposes of eradicating the pest or preventing its spread.

Requirements could include one or more of the following:

- Phytosanitary certificate issued by the exporting country to accompany importation of seed or crops from infested areas; an Additional Declaration stating freedom from *Taraxacum kok-saghyz* may also be required.
- CFIA issued import permit (Plant Protection Regulation (PPR), s. 32 or s. 43) indicating specific import requirements and conditions for the pest status, handling and use of the commodity to be procured by the importer prior to commodities from infested areas to be allowed entry to Canada. Prior to permit issuance, a facility inspection by the CFIA and verification of importer's ability to meet permit requirements may be required.
- Recognition of Pest Free Areas; if *Taraxacum kok-saghyz* can be shown by the exporting country to be absent from country/state/region from which the crop was propagated, then risk is negligible and additional regulatory requirements may be waived
- End uses and/or treatments impact risk and may therefore, impact required risk mitigation measures. Treatments may include, but are not limited to: heat treatment under approved conditions to render *Taraxacum kok-saghyz* nonviable, grinding, milling, malting or pelletizing.
- All risk mitigation measures for commodities containing *Taraxacum kok-saghyz* must be undertaken with consideration for requirements/measures for pests other than plants (e.g. pathogens and insects).

Trade Implications

- Exporting countries may have to devote additional resources toward the inspection and issuance of phytosanitary certificates. Exporters will need to ensure freedom from *Taraxacum kok-saghyz*, otherwise the CFIA can refuse import.
- Potential for reduction and or loss of some import markets for Canada should exporting countries be unable to meet proposed regulatory requirements.
- Exporters could clean seeds or grain contaminated with *Taraxacum kok-saghyz* to remove the contaminant seeds. However, *Taraxacum kok-sagyhz* seed can be difficult to clean from seeds such as forage mixtures, turf mixtures, ground cover mixtures, fescues, Canada bluegrass, Kentucky bluegrass and timothy and differentiation from *Taraxacum officinale* may be difficult.
- Field inspections or laboratory testing could be used to ensure freedom from *Taraxacum kok-saghyz* however, differentiation from *Taraxacum officinale* could be difficult.

Cost Effectiveness and Feasibility

- Resources needed by CFIA for marketplace monitoring, surveillance, inspector training and sampling of imported commodities and enforcement activities should non-compliance occur.
- Resources for seed analyst training, specimen collection and distribution. It is possible to differentiate *Taraxacum kok-saghyz* seed from that of *Taraxacum officinale* however, seeds of the two species are very similar in appearance therefore verification could not be done in the field. This will increase the verification demands of CFIA testing lab.
- If *Taraxacum kok-saghyz* is found in Canada, resources needed by the CFIA to administer and enforce Official Control (eradication or containment measures).

6.5 Pest Risk Management Options

Table 2 summarizes the risk management options considered for *Taraxacum kok-saghyz*.

Table 2: Predicted Advantages and Disadvantages of Pest Risk Management Options

Options	Advantages	Disadvantages
1 Place *Taraxacum kok-saghyz* on the *List of Pests Regulated by Canada* and Implement Official Control measures if *Taraxacum kok-saghyz* is found in Canada.	• Control over all of the pathways of introduction. • Authority to respond to incursions by applying official control measures.	• Eliminating or restricting the development and use of *Taraxacum kok-saghyz* as a potential crop in Canada • Resources needed by CFIA for marketplace monitoring, surveillance, inspector training, communication material, sampling, seed analyst training, specimen collection and distribution. Increased verification demands for testing lab. • Resources needed by CFIA to enforce the regulation if non-compliance found. • If *Taraxacum kok-saghyz* is found in Canada, resources needed by the CFIA to administer and enforce Official Control (eradication or containment measures). • Potential costs to businesses and citizens affected by the trade impacts of regulation and official measures to control any infestations, as specified in the Regulations of the *Plant Protection Act*. • Potential costs to the owner of the non-compliant good in the exporting country. • Potential costs and impacts to trading partners and trade relationships.
2 *Status Quo* - Do not place *Taraxacum kok-saghyz* on the *List of Pests Regulated by Canada*	• Research and development of *Taraxacum kok-saghyz* as a potential crop for Canada • No additional resources required for the CFIA. • No additional requirements for trade	• No authority to refuse the entry of plants of *Taraxacum kok-saghyz* for planting. • No authority to require mitigation measures for commodities contaminated with *Taraxacum kok-saghyz*. • No authority to apply official control measures to introduced or established populations.

6.6 Recommendation

The CFIA recommends Option 2.

- *Taraxacum kok-saghyz* presents a low risk to the Canadian environment and economy, to trade and to the biodiversity of native ecosystems.
- The disadvantages of regulation clearly outweigh the advantages

While the potential for introduction and spread within Canada exists, the economic and environmental impacts associated with this are anticipated to be low. Based on this, regulation of *Taraxacum kok-saghyz* as a pest under the *Plant Protection Act* is not recommended at this time.

Other considerations:

Taraxacum kok-saghyz is not currently listed on the *Weeds Seeds Order* of the *Seeds Act*, but could be considered for listing at any time in the future.

7.0 Risk Management Decision

7.1 Decision

By way of this Risk Management Decision Document, the CFIA is announcing its decision not to proceed with the regulation of *Taraxacum kok-saghyz* as a pest under the *Plant Protection Act*. Consultation on the Risk Management Document and the recommended option was conducted from June 10 - 24, 2011. Stakeholder comments received were generally supportive of the decision (see **Appendix 2** for a list of those groups consulted).

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9.0 Endorsement

Approved by:

Chief Plant Health Officer

Appendix 1: Rating Guidelines

Weed risk assessment considers the probability of introduction (entry, establishment) and spread of a potential weed, as well as the potential economic and environmental consequences. The following guidelines explain what factors are considered under each of these headings, and outline the methods for assigning and calculating ratings for risk and uncertainty.

Guidelines for Rating Probability of Entry

This rating reflects the probability that the weed will enter the PRA area. The probability of entry of a pest depends on the pathways from the exporting country to the destination, and the frequency and quantity of pests associated with them. The higher the number of pathways, the greater the probability of the pest entering the PRA area. Note that the ratings are designed to reflect the risk of entry through unintentional pathways of introduction. If the primary pathway of introduction is the intentional importation of plants for planting, a rating of "**high**" is automatically assigned, and the assessment continues with probability of establishment (below).

Rating = negligible (numerical score is 0): The probability of entry is extremely low given the combination of factors including the distribution of the weed at source, management practices applied, low commodity volume, low probability of weed survival in transit, or low probability of distribution in the PRA area given the intended use of the commodity.

Rating = low (1): The probability of entry is low but clearly possible given the expected combination of factors necessary for entry described above.

Rating = medium (2): Weed entry is likely given the combination of factors necessary for entry described above.

Rating = high (3): Weed entry is very likely or certain given the combination of factors necessary for entry described above.

Guidelines for Rating Probability of Establishment

This rating reflects the probability of establishment and potential range of a weed or invasive plant introduced into the PRA area. Factors considered include the climatic and habitat requirements of the species and the ease with which it may obtain these in the PRA area, as well as adaptability and other factors affecting its life cycle and survival. Introduced plants can be expected to behave as they do in their native area (or in other areas where they have been introduced) if suitable habitats and climatic conditions are present. Analysis may involve the use of geographic information systems (GIS) and other computerized systems such as CLIMEX to model and map potential distributions in PRA area.

Rating = negligible (numerical score is 0): The weed has no potential to survive and become established in the PRA area.

Rating = low (1): The weed has potential to survive and become established in 0-3 Plant Hardiness Zones (e.g. NAPPFAST zones 7-9) if the PRA area is all of Canada, or; the weed has potential to survive and become established in approximately one third of the PRA area, if that area is not all of Canada.

Rating = medium (2): The weed has potential to survive and become established in 4-5 Plant Hardiness Zones (e.g. The area up to and including NAPPFAST zones 5 and/or 6) if the PRA area is all of Canada, or; the weed has potential to survive and become established in approximately one third to two thirds of the PRA area, if that area is not all of Canada.

Rating = high (3): The weed has the potential to survive and become established in more than 5 Plant Hardiness Zones (e.g. The area up to and including NAPPFAST zone 4 and beyond) if the PRA area is all of Canada, or; throughout most or all of the PRA area, if that area is not all of Canada.

Guidelines for Rating Probability of Spread

This rating reflects the probability and potential rate of spread of the weed, both into and within the PRA area. A pest with a high potential for spread may also have a high potential for establishment, and possibilities for its successful containment and/or eradication are more limited. Natural means of spread may include wind, water, soil, and live vectors, all of which can transport seed, pollen, and vegetative plant parts, sometimes over great distances. Human-mediated spread may include both intentional and unintentional movement. In the case of plants intended for cultivation, this section will also consider the probability of escape and spread outside of cultivated environments.

Rating = negligible (numerical score is 0): The weed has no potential for spread in the PRA area.

Rating = low (1): The weed has potential for spread locally in the PRA area within a year (some reproductive potential and/or some mobility of propagules)

Rating = medium (2): The weed has potential for spread throughout a physiographical region of the PRA area within a year (e.g., It has either high reproductive potential OR highly mobile propagules).

Rating = high (3): The weed has potential for rapid spread throughout its potential range in the PRA area (e.g., It has high reproductive potential AND highly mobile propagules).

Guidelines for Rating Potential Economic and Environmental Consequences

This stage of the assessment considers the potential economic and environmental consequences of the weed's introduction in the PRA area. Economic and environmental consequences are considered

together as it is not always possible to fully separate them. Information from areas where the pest currently occurs is compared with conditions in the PRA area to estimate the potential importance of the pest. Case histories concerning comparable pests, and intrinsic biological traits that may contribute to pest impacts (e.g., parasitism, allelopathy, thorns, etc.) may also be considered.

Consequences may be direct or indirect, and both should be evaluated as much as is possible. Sometimes indirect effects may be more difficult to evaluate as they require the consideration of side effects of a pest's establishment that may not be immediately apparent. Care should be taken not to take the evaluation of indirect effects to extremes, but to keep them limited to one or two orders of separation away from the direct effects. Probably some of the most common indirect effects are social consequences, secondary habitat consequences of control / eradication efforts and secondary habitat consequences of ecological changes induced by the pest.

Economic factors considered include impacts on crop production costs, yield, quality, and marketability, and variability of impacts among crop cultivars or varieties. Crops considered include cultivated and forest species, but only those that are managed.

Environmental factors considered include impacts on non-agricultural host(s) and natural ecosystems. This may include subjective consideration of direct biotic effects on endangered or threatened natural species and reduction of biodiversity. Examples of abiotic impacts considered include ecosystem destabilisation, environmental degradation, fire, and impacts on recreation and aesthetic values. Also considered are impacts on human and animal health, and indirect environmental effects of risk management options (e.g., pesticides).

A more detailed economic assessment than provided here may be required in some cases.

Rating = negligible (numerical score is 0): The weed has no potential economic impact and no potential to degrade the environment or otherwise affect ecosystems (e.g., cuses none of the above-listed impacts).

Rating = low (1): The weed has a limited potential to cause economic impacts or affect the environment (e.g., Causes one of the above-listed impacts unless there is potential to reduce populations of threatened or endangered species, in which case rating should be "**high**").

Rating = medium (2): The weed has moderate potential to cause economic impacts (e.g., Causes two of the above-listed economic impacts **or** any one of these impacts on a wide range of economic plants, plant products, or animals (over 5 types)) or it has potential to cause moderate changes in the environment, such as obvious change in the ecological balance (affecting several attributes of the ecosystem), as well as moderate recreation or aesthetic impacts. (e.g. Causes two of the above-listed environmental impacts).

Rating = high (3): The weed has significant potential to cause economic impacts (e.g., Causes all the above-listed impacts, **or** causes any two of these impacts on a wide range of economic plants, plant products, or animals (over 5 types) or it has potential to cause major damage to the environment with significant losses to plant ecosystems and subsequent physical environmental degradation (e.g. has potential to reduce populations of threatened or endangered species, **or** affects three or more of the above-listed impacts).

Guidelines for Rating Uncertainty

Because of the quality or nature of the evidence available, risk assessors are not always completely confident of the ratings assigned to risk elements. In general, quantitative data, multiple independent data sources and expert information lowers uncertainty. 'Low-quality' sources, assessor interpretations and a lack of evidence raise uncertainty. If relevant, clear and reasonably certain congeneric information may be used to support ratings assigned to risk elements; however, the uncertainty level should be raised by at least one level. Information from several congeners may be used to reduce uncertainty. The following ratings are adapted from the draft APHIS Weed Risk Assessment guidelines.

Rating = negligible (numerical score is 0): There is direct evidence regarding the risk element. Only use negligible uncertainty when there is very little doubt from the literature, when the risk

assessor is considered an expert on the plant, or when the risk assessor has communicated directly with an expert regarding the question.

Rating = low (1): There is direct evidence for the risk element in question and the source is considered reliable. For introduction pathways, low uncertainty may also be appropriate if the species is relatively well studied or known and the pathway is considered unlikely based on lack of evidence.

Rating = medium (2): There is direct or indirect evidence for the risk element in question and sources are of moderate quality. For introduction pathways, medium uncertainty may also be appropriate when a species is moderately well studied or known and the pathway is considered unlikely based on lack of evidence.

Rating = high (3): Evidence is poor or lacking and/or sources are considered low quality. Use high uncertainty when little is known about the species (alternatively, it may be more appropriate to rate the risk element as 'unknown').

Guidelines for Calculating Overall Risk and Uncertainty Ratings for Probability of Introduction and Spread

The individual risk ratings given in examining the three probability factors, (i.e., probability of entry, probability of establishment and probability of spread) are taken into consideration to produce an overall rating for the probability of introduction and spread of the weed. This is done by translating the individual risk ratings into numerical scores (negligible = 0; low = 1; medium = 2; high = 3), and multiplying the numerical scores to produce a product score, as follows:

Probability of introduction and spread = Probability of entry x Probability of establishment x Probability of spread

Depending on the resulting overall score, the consequences of introduction will be rated as negligible (0), low (1-3), medium (4-12) or high (>12). The underlying assumption behind this approach is that the three factors are dependant, that is, all three would need to occur for there to be a risk. The table below is provided as a guide.

Product Scores (Probability of Entry X Probability of Establishment X Probability of Spread)	Overall Rating for Probability of Introduction and Spread
0	Negligible
1 - 3	Low
4 - 12	Medium
>12	High

In the case of uncertainty ratings, an overall uncertainty score is calculated for the probability of introduction and spread by translating the individual uncertainty ratings into numerical scores (negligible = 0; low = 1; medium = 2; high = 3), and adding the numerical scores. Depending on the resulting overall score, the uncertainty will be rated as negligible (0), low (1-3), medium (4-6) or high (7-9). The underlying assumption behind this approach is that the three uncertainty scores are additive, not dependant. The table below is provided as a guide.

Additive Scores for Uncertainty of Overall Probability of Introduction and Spread	Overall Rating for Uncertainty of Probability of Introduction and Spread
0	Negligible
1 - 3	Low
4 - 6	Medium

Additive Scores for Uncertainty of Overall Probability of Introduction and Spread	Overall Rating for Uncertainty of Probability of Introduction and Spread
7-9	High

Appendix 2: Consultation

The following stakeholders were consulted:

1. Federal agencies or official organizations
2. Provincial departments
3. Industry
4. Other organizations including but not limited to,
    - Invasive Plants Councils
    - Academia
    - Non-governmental associations

Significant support for this regulatory decision was received through responses from provincial and federal departments and other stakeholders consulted. Suggested comments and revisions were included to this document when appropriate.

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1 Rating guidelines for risk and uncertainty are provided in **Appendix 1**.

2 Seed intended to be grown in contained trials for research purposes may be considered for import under permit. The import permit will outline requirements for pest status, handling, use, containment and disposal. Importers are responsible for applying for and procuring all permits. Importing facilities are subject to CFIA inspection

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