

Feasibility for the Expansion of Seed Potatoes in Northwest Manitoba (Parkland)



Agriculture and
Agri-Food Canada

Prairie Farm Rehabilitation
Administration

Agriculture et
Agroalimentaire Canada

Administration du rétablissement
agricole des Prairies



Canada 

Acknowledgements

This project was initiated under an agreement between Keystone Agricultural Producers and the Prairie Farm Rehabilitation Administration to develop and deliver decision support systems for sustainable agricultural resource development planning to municipal governments in Manitoba.

Financial and technical support for the project was provided by Western Economic Diversification, Keystone Agricultural Producers, Prairie Farm Rehabilitation Administration, Parkland Crop Diversification Foundation, and the Rural Municipality of Shell River.

This report provides the Rural Municipality of Shell River and the Parkland Crop Diversification Foundation with valuable tools and knowledge that will assist them in making informed decisions regarding sustainable agricultural and rural development, protecting the water and soil resource.

The report was prepared by:
Jamie Hewitt and Jeff Thiele

2001

Abstract

The expansion of seed potato production in the Parkland region of Manitoba could be a potential diversification opportunity for local producers. To grow seed potatoes, one must have adequate climate, and soils that are free of heavy clays and stones and have no salinity. The RM of Shell River in association with the Prairie Farm Rehabilitation Administration (PFRA), Keystone Agricultural Producers (KAP), the Parkland Crop Diversification Foundation (PCDF), and Manitoba Agriculture and Food have partnered up to help identify the approximate number of acres and the general areas where seed potato production would be best suited. A Geographical Information System (GIS) was used to create maps to identify areas best suited to seed potato production based on soils, climate, and landuse information. These maps will serve as a reference guide and the beginning step in identifying fields for seed potatoes. Final suitability for production will be determined by field level inspections and may involve future GPS and EM technologies. Approximately one quarter (195,649 hectares or 483,000 acres) of the Parkland's annual crop land base is potentially suited for seed potato production, much more than the area that would be needed to meet the expected rise in demand for seed potatoes that should result from the expansion of a new commercial potato processing plant in Portage la Prairie.

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1.0 Introduction

Currently most of Manitoba's seed potato production occurs in an area between Carberry and Portage la Prairie and south to Winkler and occurs in close proximity to commercially produced potatoes. With seed production fields so close to the commercial production fields it is difficult to avoid a high level of disease pressure on the seed potatoes. Therefore, it could prove advantageous to the industry to reduce the disease pressure on seed potatoes by moving the seed fields north, into the Parkland region. At present there is 3,800 hectares (9,000 ac) of seed potatoes produced in Manitoba to supply approximately 30,400 hectares (75,000 ac) of commercial potato fields in Manitoba (Lidget and Rex, 2000). There is also an increasing quantity of seed potatoes being shipped to other provinces and the U.S. With the announcement of a new potato processing plant for Portage la Prairie commercial potato production in Manitoba could be raised by another 12-15,000 hectares (30-40,000 ac), also creating a larger demand for disease free seed potatoes.

Trials in the Dauphin area have been carried out by Manitoba Agriculture and Food, and were successful in producing suitable seed stock (PCDF, 2000), demonstrating that the Parkland area (at least in the trial locations) is viable for expansion into seed potatoes. In order to assist producers in sustainable growth of the industry it is necessary to identify the areas best suited for this expansion. This is especially important since transforming from strictly grains to seed potatoes incurs a sizeable capital investment and can therefore be a high risk venture.

An ideal tool for conducting a preliminary investigation of the feasibility of seed potato production is a Geographical Information System (GIS). This is a relatively new tool which allows the user to spatially display data and perform analysis on the data. All results can be mapped in an accurate fashion and utilized for decision making purposes, identifying potential areas that are best suited for seed potatoes and narrowing the focus of field trials to areas predicted to be sustainable.

2.0 Project Description and Objectives

With the recent announcement of the new potato processing plant in Portage la Prairie and the problems of producing disease free seed potatoes in southern Manitoba, there is a window of opportunity to expand seed potato acres north into the Parkland. To help facilitate the sustainable expansion and diversification of seed potatoes, PFRA in conjunction with the Parkland Crop Diversification Foundation (PCDF), Manitoba Agriculture and Food (MAF) Keystone Agricultural Producers (KAP) and the RM of Shell River, initiated this feasibility study. The study analyzed soil, landuse and climate data in a GIS environment and identified the areas best suited to seed potato production. Study results will be used to narrow the focus of field level analysis that will be required to determine site specific seed potato production suitability.

The deliverables at the conclusion of the project will include:

- i) a methodology that supports resource based decision making by local governments to deal with crop diversification
- ii) demonstrated capacity among participating local governments to utilize advanced decision making tools on their decision making
- iii) reports for each participating local government that includes hard copy (tabular and map form) results of analysis
- iv) digital products and data for continued analysis by the Parkland Crop Diversification Foundation and the Rural Municipality of Shell River.

3.0 Methodology

Three essential data sets were identified for the purpose of this project: soils, climate and landuse. The general method employed was to rate each data set on its own for non-irrigated seed potato production potential, then merge them together, and apply an overall rating scheme.

3.1 Data

Soil Data

A significant factor in determining the feasibility of seed potato production in northwestern Manitoba is the soil suitability for potatoes. Ideally, potatoes require a well drained, light textured (sandy loam to loamy sand) soil, with no stones and no salinity. The soils data used for the study consisted mostly of the 1:125,000 and 1:126,720 reconnaissance data collected from the 1950's-1970's and digitized recently during the mid 1990's. This data is recognized as being at a coarse scale, and thus may not be accurate down to the field scale level. Also, many of the soil's characteristics may have changed slightly since the 1950's and 1970's when the data was originally collected (eg. drainage improvements). However, on a regional scale this data will indicate approximate areas available for seed potato production that can be followed up with a site specific analysis

In rating the soils for seed potato production in the Parkland a methodology similar to one employed by the Manitoba Land Resource Unit for determining soil capability for commercially grown irrigated potatoes was used. After collecting all of the digitized soils data each soil polygon (area of soil with like physical and chemical characteristics) was then rated for seed potatoes production based on the soil characteristics of surface texture, drainage, stoniness, topography, salinity, and soil order. Characteristics were rated on a scale of 1 to 5 with Class 1 rated as the best suited for seed potatoes, Class 4 as the least suited and Class 5 a unsuited for seed potatoes. Table 1 illustrates the rating scheme that was applied to each soil characteristic for each soil polygon in the database.

An overall rating scheme for each soil polygon was then applied corresponding to the lowest individual rating , which would be the most severe limiting factor for production, of any one of the soil characteristics. For example, soil polygons having the lowest individual characteristic rating of 5 would receive an overall rating of Class 5, while a soil unit with the lowest individual characteristic rating of 3 would have an overall rating of Class 3. (Table 2).

Table 1: Soil characteristic rating scheme for non-irrigated seed potatoes

Characteristic / Property	Soils Suitability Rating				
	Class 1	Class 2	Class 3	Class 4	Class 5
Texture Classes	Coarse Loams	Fine loams Loamy Sands Fine Sandy	Clay Loam		Clayey Exposed Rock Undifferentiated
Drainage Classes	Well	Well	Imperfect Poor - Improved Rapid	Poor Very Poor	
Stoniness	N St	N St	N St	S St	>S St
Topography (Slope)	0-5%	0-5%	0-5%	5-9%	>9%
Salinity	N Sa	N Sa	W Sa	M Sa	> M Sa
Soil Order			Orthic Regosol		Organic Solonetzic

Stoniness

N St Non Stony (<0.01% surface covered)
S St Slightly Stony (0.01 - 0.1 % surface covered)

Salinity

N Sa - Non Saline (0-2 mS/cm)
W Sa- Weakly Saline (2-4 mS/cm)
Msa- Moderately (4-8 m/Scm)

Table 2: Example of overall rating for soil suitability for non-irrigated seed potatoes

	Surface Texture	Drainage	Topography	Stoniness	Salinity	Soil Order	Overall Rating	Polygon
Characteristics Class Rating	Loamy Sand 2	Well 1	0-2% 1	0.1-3% 1	0-2mS/scm 1	1	5	1
Characteristics Class Rating	Fine Sand 2	Well 1	0-2% 1	0-0.01% 1	0-2mS/scm 1	Orthic Regosol 3	3	2

Climate Data:

Climate data was obtained from Manitoba Agriculture and Food, Soils and Crops Branch. The data was created using Idrisi and models the accumulation of annual P-days (useful heat units), frost-free days (growing season), and water deficit to maturity of potatoes (water stress), all reflecting a 10% risk. This means, for example, that 1 out of 10 years the observed P-days and frost free days would be less than the values given on the map. However, upon preliminary analysis it was difficult to accurately define or apply a rating scale to climate similar to the soils data, based on the water stress and the growing season information as more field trial research is needed to be able predict the effect of climate on non-irrigated seed potatoes in the Parkland. However, some interpretation can be made on the P-days data. P-days is a measure of useful heat units for potato growth and is dependent on the optimal growing temperature for potatoes. Commercial potatoes need from 800 - 1,000 P-days, where as 650-750 P-days is more than

adequate for seed potatoes (PCDF, 2000). To reflect this, the climate data was rated on P-days in the following manner, <500 P-days was considered unsuitable, while 500 to 600 P-days is given a risk of low P-days, and >600 P-days was considered the best suited areas for seed potatoes.

Landuse Data:

The land cover data used for the Parkland area is the 1994 classified imagery and was obtained from RadarSat International. The imagery was classified by the Manitoba Remote Sensing Centre into seven classes: Annual Crop Land, Forages, Grasslands, Trees, Water Bodies, Wetlands, and Urban/Transportation. From this data all of the annual cropland was selected and rated as being suitable for seed potatoes, while all other categories were selected out and classified unsuitable, revealing the available land in the Parkland area, which is potentially available for seed potato production.

After applying the preliminary rating schemes, to the soil, landuse and climate, the three layers of data were analyzed together by employing a simple 'overlay' system. The 'overlay' scheme illustrated the most suitable soils, already in annual crop production, which can be easily converted and should support non-irrigated seed potatoes.

4.0 Analysis and Discussion

Analysis of the soils data shows that approximately half (49.36%) of the Parkland is classified as unsuitable (Class 5) for potato production (Map 1 and Table 3). Class 5 ratings can be mainly attributed to areas with marshy regions and organic soils, or stony soils. An additional 25.9% of the soils in the Parkland area are rated as Class 4 (least suitable for seed potatoes), which is also mainly due to stoniness. Stoniness is an undesirable soil characteristic due to the fact that stones can easily be picked up during harvest and then accidentally sent through the knives during the seed cutting process, or cause bruising on the potatoes themselves, as well as damaging other equipment.

Table 3: Soil rating for seed potatoes in the Parkland area

Soil Rating	Hectares	% Land
Class 1	3, 531	0.15
Class 2	79,156	3.42
Class 3	347,202	15.01
Class 4	598,802	25.88
Class 5	1,142,001	49.36
Water	32,039	1.38
Unclassified	110,897	4.79

Class 1, 2, and 3 soils for seed potato production ranged from loamy fine sands to clayey loams. Most were found associated to river valley alluvial deposits in the Dauphin Lake Plain (eg. Edwards series), and lacustrine deposits in the Swan River Valley (eg. Poppleton and Swanford series) and in the Ste Rose area (eg. Plum Ridge series). There was also some moranian till soils in the RM's of Russell and Silver Creek, most of which were Newdale series. Most of the soil suited to seed potato production in the area was given a Class 3 rating (15.01% of the area), with smaller pockets of soil rated as Class 2 and Class 1 (3.42% and 0.15% of area, respectively). For most of the soils rated as Class 3 for seed potato production, the most limiting factor was internal drainage being rated as imperfect.

The climate data gathered shows that most of the Parkland has an annual accumulation of P-days of 600-650, with smaller localized pockets higher than 650 (Map 2 and Table 4). The best areas for potato production in the Parkland area, based on P-days, appears to be in the RM of Ste Rose, Dauphin, and Swan River. However, other areas should not be discounted, as 650-750 P-days for seed potatoes is adequate to produce harvest weight and size (PCDF, 2000). Map 3 shows the distribution of frost free days and water stress on potatoes. Although not included in the overall rating scheme and created for assessing areas for commercial potatoes, this data is useful in noting as these other climate factors do play a role in seed potato growth and maturity and can be included in overall analysis of seed potato production in the future with more field level research.

Table 4: Summary of P-days for the Parkland area

P-days	Hectares	% Land
> 600	1,944,136	70.63
500-600	401,511	14.22
<500	427,797	15.15

Analysis of the land cover data reveals that there is 709,630 hectares of annual cropland in the Parkland, which could be available for seed potatoes.

After combining the soils data, with the 1994 land cover data and the available climate data, 195,649 hectares, or about one quarter of the total crop land is found to be potentially best suited for expansion of non-irrigated seed potatoes in the Parkland (Map 4 and Table 5). An additional 40,817 hectares are found to be potentially suitable, but have a lower P-day rating, which may restrict the growth of seed potatoes here. This area is found mostly in the Gilbert Plains area, as shown on Map 4. This results are only an indication of where seed potatoes can be produced. As such, one should be cautious when interpreting these results, since all fields need to be surveyed at field level to determine their final suitability for seed potato production.

Table 5: Summary of overall suitability for non-irrigated seed potatoes in the Parkland Area

Overall Rating	Hectares	Rating Scheme
Best Suited	195,694	Cropland with Class 1, 2 or 3 soils and >600 P-days
Suitable	40,817	Cropland with Class 1, 3 or 3 soils and 500-600 P-days
Unsuitable	473,164	Cropland with Class 4 or 5 soils, or < 500 P-days

5.0 Summary and Conclusions

While site specific field level analysis is required to determine final suitability for seed potato production, the data clearly indicates that the potential land available for seed potato production (195,649 hectares) in the Parkland exceeds the hectares needed to meet the expected rise in demand for seed potatoes. Seed potatoes could give some Parkland region farmers another alternative crop, one capable of high returns, while at the same time producing seed potatoes at a reduced risk of diseases. While seed potato production in the Parkland is an economic opportunity for producers, it can also be a high risk capital venture. New equipment and storage facilities, specific to potato production, will be needed for producers entering into this new economic opportunity. This is expected to be the greatest limiting factor to producers looking into seed potato production.

Seed potato production in the Parkland would not only be an advantage to producers, but to the Manitoba potato industry as well. Producing seed potatoes in the Parkland, away from the commercial potato fields, would assist in lowering the disease risk to seed potatoes and may produce a healthier seed stock.. To get the highest yields possible with the lowest inputs from commercially grown potatoes, seed potatoes must be free of diseases

5.1 Future Steps

The results of this study showcase the usefulness of GIS in analyzing and locating general areas suitable for seed potatoes. This study will give all RM's in the Parkland, and agricultural field staff within PFRA, Manitoba Agriculture and Food (MAF) and PCDF as a starting point in locating potential sites for seed potato production trials, as well as to generate interest from potential producers to consider expanding into seed potato production. The results will lead into the on-going continuation of projects for PFRA, MAF and PCDF addressing seed potato production in the Parkland. An immediate follow up to this study would be to refine the existing data and model to include more specific information on harvest weight and size of seed potatoes grown in the Parkland under non-irrigation conditions. The information should also be expanded and provided on an RM by RM basis instead of on a regional basis. This will provide better information to producers and may help generate more interest in seed potato production in areas where it is potentially suitable. Finally, there will also be the need to follow up on field level investigations of potential sites, when interest is generated by producers.

6.0 Data Sources

Climate Data: Manitoba Agriculture and Food, created in Idrisi original pixel size 479 meters, 1997. Converted to shape file, 2001. Soils and Crops Branch, Carman, Manitoba.

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