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Nitrogen, enough or too much?

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Vert Nature INC.

With the collaboration of

PHYTODATA Inc.

2012

2013

2014



Observations

- Onion Prince
  - Poor soils (+)
  - Under dry season (+)
  - Rich soil (-)
  - Rainy and cool weather (-)

- Growers that succeed growing “Prince” do not necessary succeed growing Frontier (or Mountaineer) or vice-versa



Observations

- Regional adaptations
  - Grand Bend
  - Bradford
  - Sherrington
- Different soils
- Bacterial rot disease pressure



Hypothesis

- Vigorous rooted varieties (Prince, Safrane, etc) require less Nitrogen
- High Nitrogen rate on those varieties favor too much the vegetative growth delaying the maturity
- Higher Nitrogen rate favor bacterial rot infection

What is the optimal dose???

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Notre focus:
vos oignons!



Frontier, Trekker, Trailblazer, Adventure



The goals

- Compare different Nitrogen concentration on varieties with poor root vs strong root development
- Prove that varieties with stronger root development requires less Nitrogen for better performance
- Demonstrate that a lower Nitrogen rate reduce bacterial rot

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2012

2 sites :

- **Frontier vs Tahoe**
- **Adventure vs Safrane**



Méthods

- Split Splot assortment
- 4 repetitions
  - 2 varieties
  - 3 Nitrogen concentration
- Plot dimension
  - 8 meters (long) x 4 rows (double)

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Implantation dates

	SITE 1	SITE 2
• Fertilisation	May 11	May 18
Side dress	June 7	June 19
• Harvest	September 11	September 11
• Storage evaluation	March 11, 2013	April 9, 2013

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Nitrogen application rates

T1: 0 kg/ha

T2: 50% of the suggested recommendation, or 45kg/ha of 27-0-0, with additional 20kg/ha as a side dress at 2-3 leaves stage

T3: 100% of the suggested recommendation, or 90kg/ha of 27-0-0, with additional 40kg/ha as a side dress at 2-3 leaves stage

Phosphorus: 100 kg/a (*)
Potash: 280 kg/ha (*)

*** As per CRAAQ (Quebec Fertilisation Reference Guide)**



Harvest



Harvest parameters

- **Harvest done from the 2 center rows of each plot (6 meters long)**

- **Harvest calibration**

  - ✓ **Jumbo: diameter > 7,62 cm (3”)**
  - ✓ **Large: diameter of 7,00 to 7,62 cm (2 ¾” to 3”)**
  - ✓ **Medium: diameter of 6,35 to 7,00 cm (2 ½ to 2 ¾”)**
  - ✓ **Small: diameter of 5,72 to 6,35 cm (2 ¼ to 2 ½”)**
  - ✓ **Rejects**

    Rejects nature:
    - **Too small**
    - **Rot**
    - **other**

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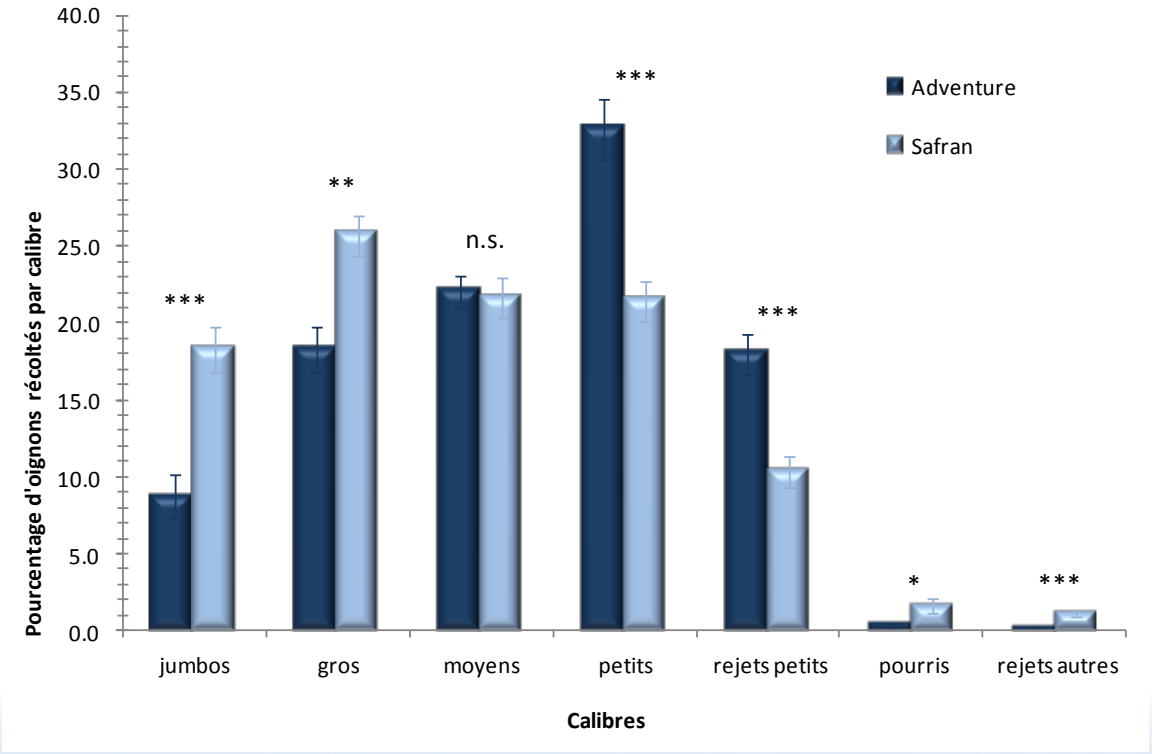
Onion size % versus sizes

Site 1 – Adventure – Safran :



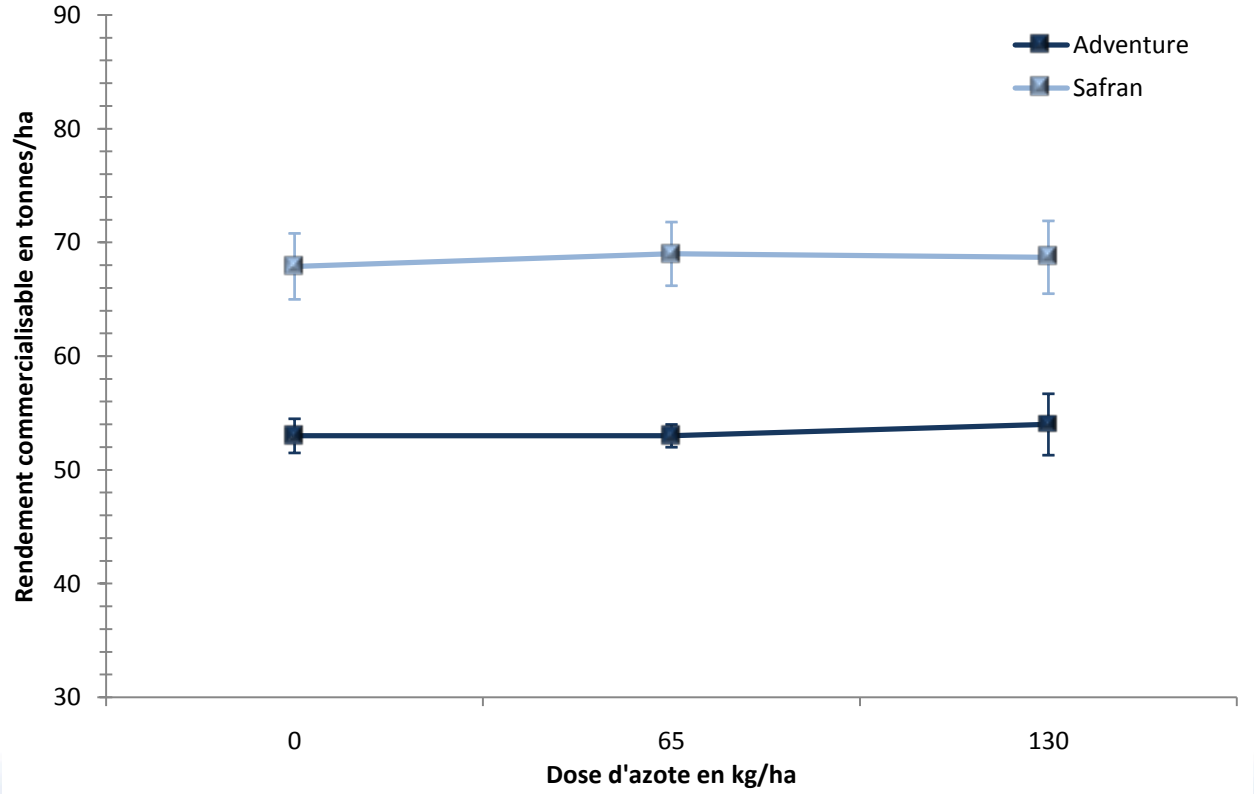


Onion size % versus sizes

- **Safrane**
  - Larger % of large and jumbo whatever the Nitrate rate
  - More rejects in Adventure (but only .2 to 2.2% of marketable yield)
  - Difference of 4 tons/ha between total yield and marketable yield
  - Difference of 15 tons/ha between Safrane and Adventure



Marketable yield vs Nitrogen application rate





Marketable yield vs Nitrogen application rate

- No yield difference with the 3 different rates of Nitrogen applied for one variety

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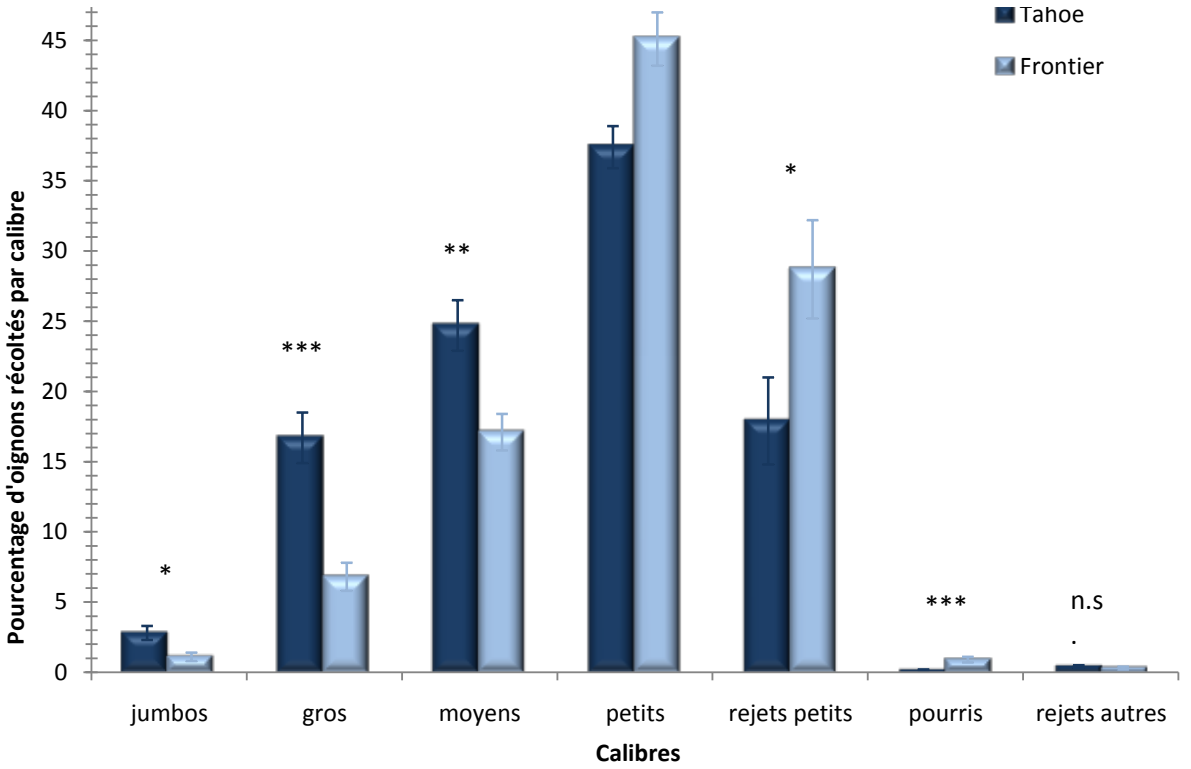
Marketing yield vs Nitrogen application rate



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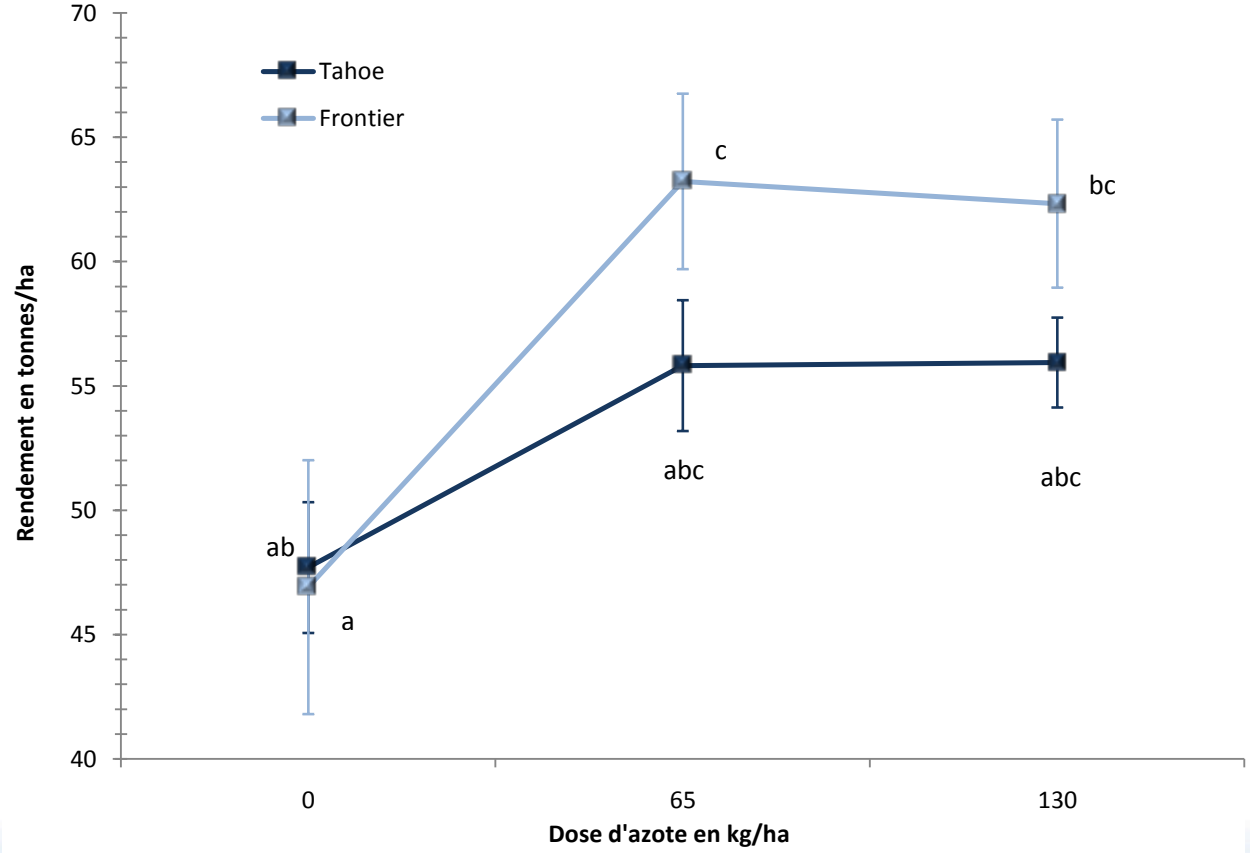
Marketable yield vs Nitrogen application rate





Marketable yield vs Nitrogen application rate

- Maximum yield for both varieties at 65kg/ha
- No yield increase over 65kg/ha Nitrogen application
- Frontier yield decrease faster than Tahoe's yield at 0% application rate



Post-harvest evaluations

- **Weight before and after storage**

Site 1 – Adventure – Safran :

Tableau 2. Poids avant et après entreposage, site 1

variété	Traitement	poids moyens avant entrepot (kg) 30 oignons	poids moyens après entreposage (Kg) 30 oignons	% perte
Adventure	T1	5,20	4,95	4,75
	T2	5,20	4,94	4,85
	T3	5,12	4,83	5,67
	moyenne	**5,17 a**	**4,91 a**	**5,09% a**
Safran	T1	5,41	5,02	7,21
	T2	5,34	4,97	6,78
	T3	5,40	5,04	6,58
	moyenne	**5,38 b**	**5,01 a**	**6,86% b**
Variety	**rate**	**before**	**after**	**% loss**



Post-harvest evaluations

- **Qualitative evaluation**

Tableau 3. Évaluations qualitatives, site 1

Variété	Traitement	% oignons sains	% pourriture	% doubles	% déformés	% éclatés
Adventure	T1	99,17	0,83	0,00	0,00	0,00
	T2	98,75	1,25	0,00	0,00	0,00
	T3	97,08	1,67	0,42	0,42	0,42
	moyenne	**98,33**	**1,25**	**0,14**	**0,14**	**0,14**
Safran	T1	96,21	2,95	0,85	0,00	0,00
	T2	98,33	1,67	0,00	0,00	0,00
	T3	96,67	2,50	0,42	0,00	0,42
	moyenne	**97,07**	**2,37**	**0,42**	**0,00**	**0,14**

Variety	**rate**	**Mkt onions**	**% decay**	**% double**	**% misshaped**	**% splitted**



Post-harvest evaluations

- No difference in weight between the 3 Nitrogen rates on both varieties (before storage)
- Significant weight loss on Safrane (after storage)
- More rot rejects (2.37%) on Safrane vs Adventure (1.25 %)
- Adventure rot % increase with higher Nitrogen rate which is not the case for Safrane



Post-harvest evaluation

Table 4. Average weight before and after storage

Variété	Traitement	Moyenne de poids avant entrepot (kg) 30 oignons	Moyenne de Poids après entreposage (kg) 30 oignons	% perte
Frontier	T1	4,63	4,30	7,32
	T2	4,65	4,36	6,13
	T3	4,69	4,38	6,74
	moyenne	**4,66 a**	**4,35 a**	**6,73% a**
Tahoe	T1	4,70	4,31	8,34
	T2	4,87	4,51	7,37
	T3	4,74	4,39	7,2
	moyenne	**4,77 a**	**4,40 a**	**7,71% b**
Variety	**treatment**	**before**	**after**	**% loss**



Post-harvest evaluation

Table 5. Qualitative evaluation

Variété	Traitement	% oignons sains	% pourriture	% éclatés	% pelure tachée	% germés	% Botrytis
Frontier	T1	98,82	0,40	0,78	0,00	0,00	0,00
	T2	97,23	0,00	0,40	0,00	0,00	2,36
	T3	97,63	1,97	0,00	0,00	0,40	0,00
	moyenne	**97,89**	**0,79**	**0,39**	**0,00**	**0,13**	**0,79**
Tahoe	T1	92,92	0,78	1,74	0,69	0,69	3,17
	T2	99,21	0,00	0,00	0,00	0,39	0,40
	T3	95,49	0,00	1,47	0,00	0,40	2,63
	moyenne	**95,87**	**0,26**	**1,07**	**0,23**	**0,50**	**2,07**

Variety	**treatment**	**Mkt onions**	**% decay**	**% split**	**% stained**	**% sprout**	**% Botrytis**



Post-harvest

- Important yield decrease on both varieties at 0% Nitrogen rate
- No qualitative difference



Conclusion

- Varieties with strong root development tolerates lower Nitrogen rate without affecting the yield
- Under 2012 conditions, 65kg/ha look like the optimal rate on both varieties
- Nitrogen rate recommendation cannot be the same on every variety
- Need to repeat the trial in 2013

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2013

1 site :

- **Advanced trial on plots of 65,000 s.f. and more**
- **Frontier vs Patterson**

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Experimental field

1 : Dispositif essai fertilisation

Champs #91

80' 1 tour épandeur 25%N AC-15	80' 1 tour épandeur 50%N AC-14	80' 1 tour épandeur 100%N AC-4	80' 1 tour épandeur 100%N AC-4	40' 1 passe épandeur 50%N AC-14	40' 1 passe épandeur 25%N AC-15	Le reste du champs 100%N AC-4
Patterson			Frontier			
3.12 ac 1.26 ha	3.12 ac 1.26 ha	3.12 ac 1.26 ha	3.12 ac 1.26 ha	1.56 ac 0.63 ha	1.56 ac 0.63 ha	.+/- 3.75 ac .+/- 1.5 ha
8 parcelles	8 parcelles	8 parcelles		8 parcelles	8 parcelles	8 parcelles

1,700 pi de long



Experimental field



Nitrogen application rate

- **25 % of suggested rate or 30 kg/ha**
- **50 % of suggested rate or 60 kg/ha**
- **100 % of suggested rate or 90 kg/ha + 30 kg/ha as side dress**

Phosphorus: 100 kg/ha
Potash: 280 kg/ha



Data collection

- Split Splot assortment
- 8 repetitions
  - 2 varieties
  - 3 Nitrogen application rate



Harvest data

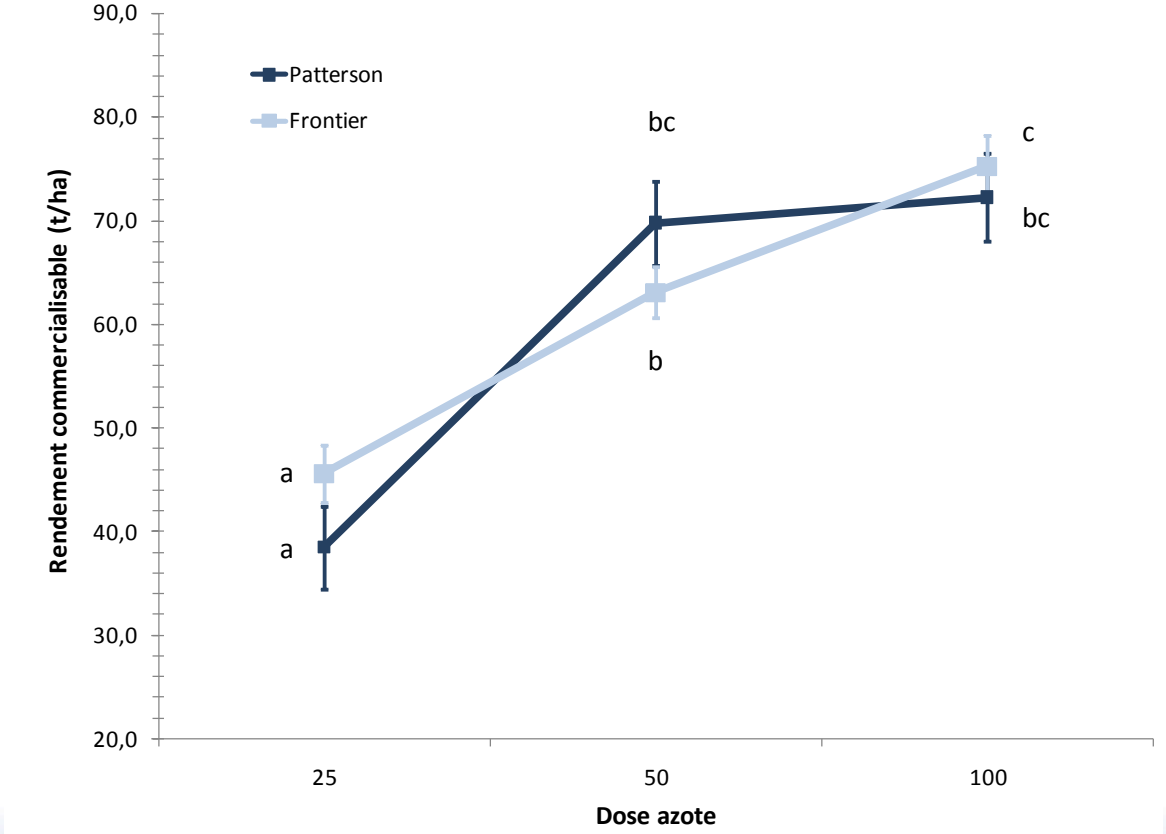
- **Collection on the 2 middle rows of the plot on 6 meters long**

- ✓ **Jumbo: diameter > 7,62 cm (3”)**
- ✓ **Large: diameter of 7,00 to 7,62 cm (2 ¾” to 3”)**
- ✓ **Medium: diameter of 6,35 to 7,00 cm (2 ½ to 2 ¾”)**
- ✓ **Small: diameter of 5,72 to 6,35 cm (2 ¼ to 2 ½”)**
- ✓ **Rejects**

Rejects nature:
- **Too small**
- **Rot**
- **other**



Marketable yield



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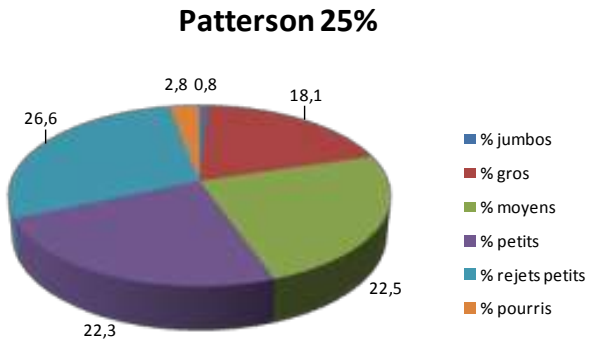
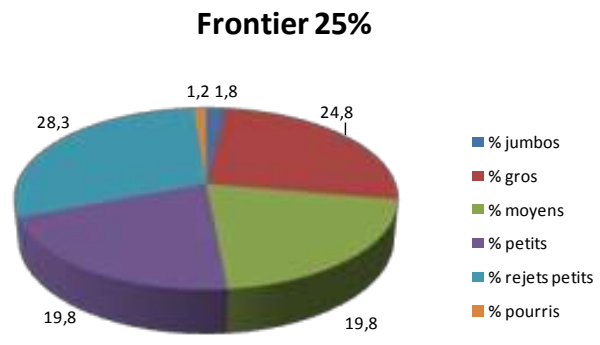
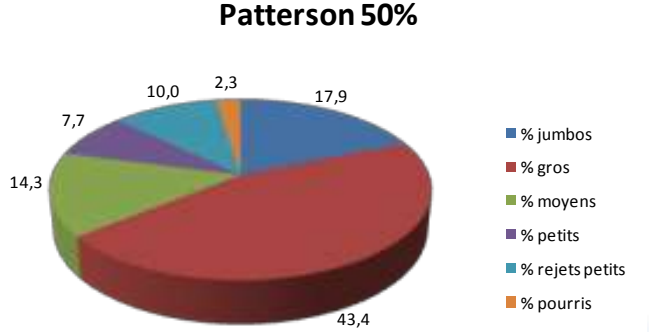
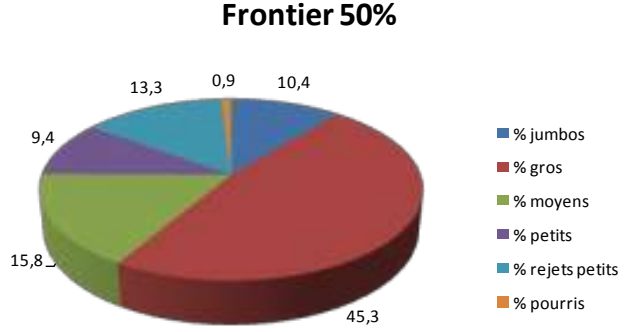
Sizes repartition vs Nitrogen rate









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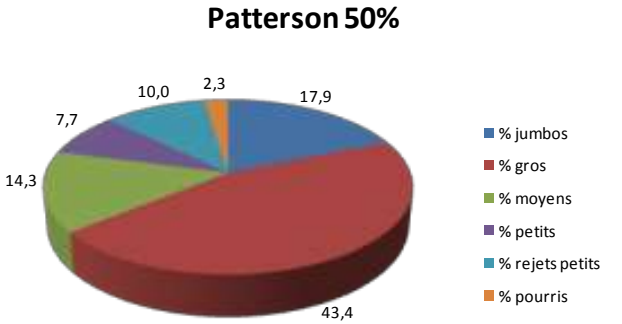
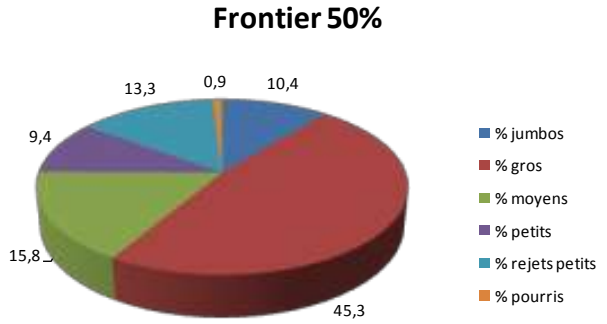
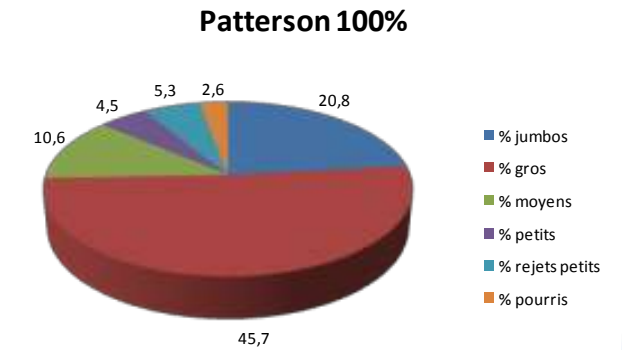
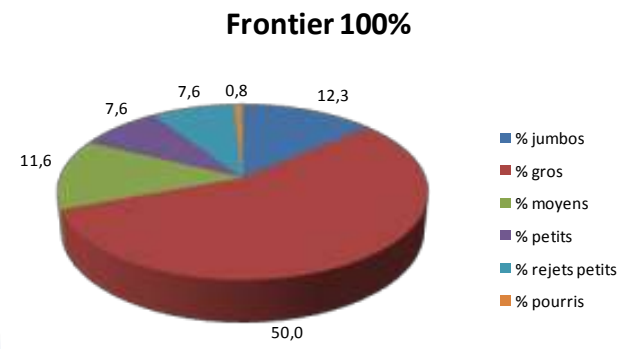
Sizes repartition vs Nitrogen rate









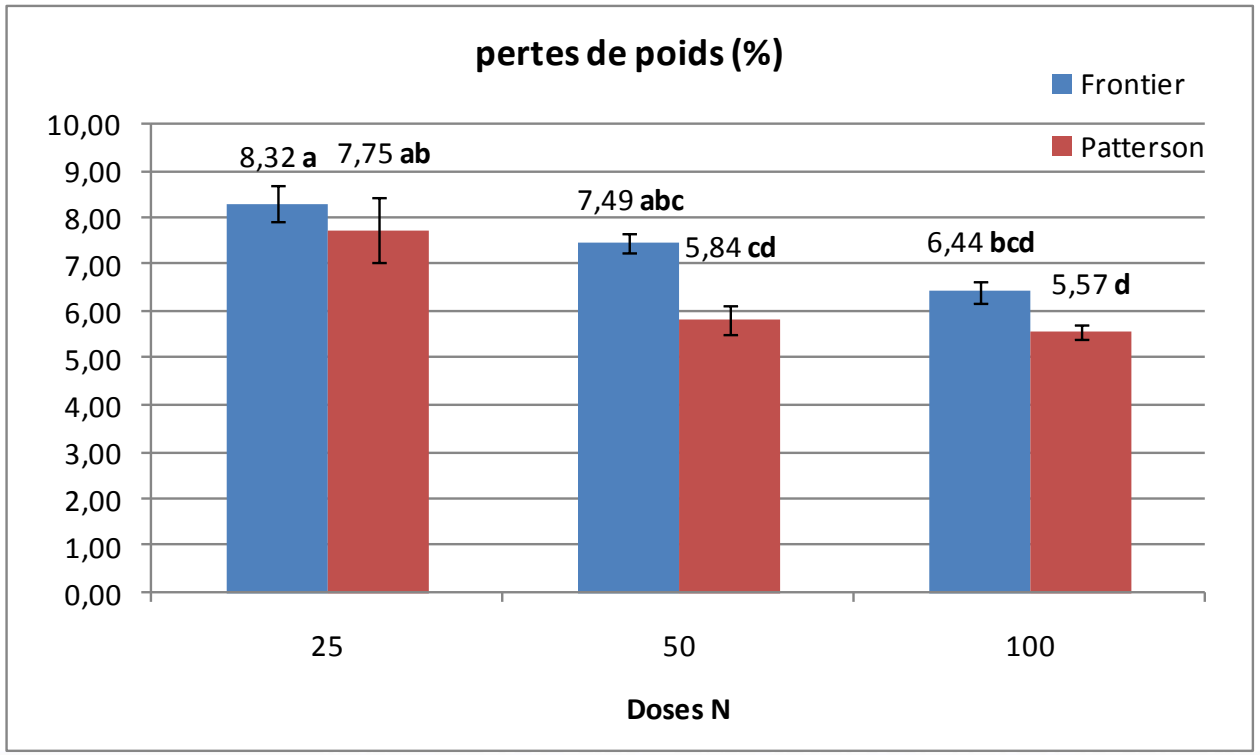


Conclusion

- The optimum Nitrogen rate on Patterson is 60 kg/ha (50%), while it is between 60 kg/ha and 120 kg/ha for Frontier
- Both varieties end up with lower yield and more small onions at a Nitrogen rate of 30 kg/ha (25%)
- Both varieties end up with the same size % and the % of small onions increase with higher rate

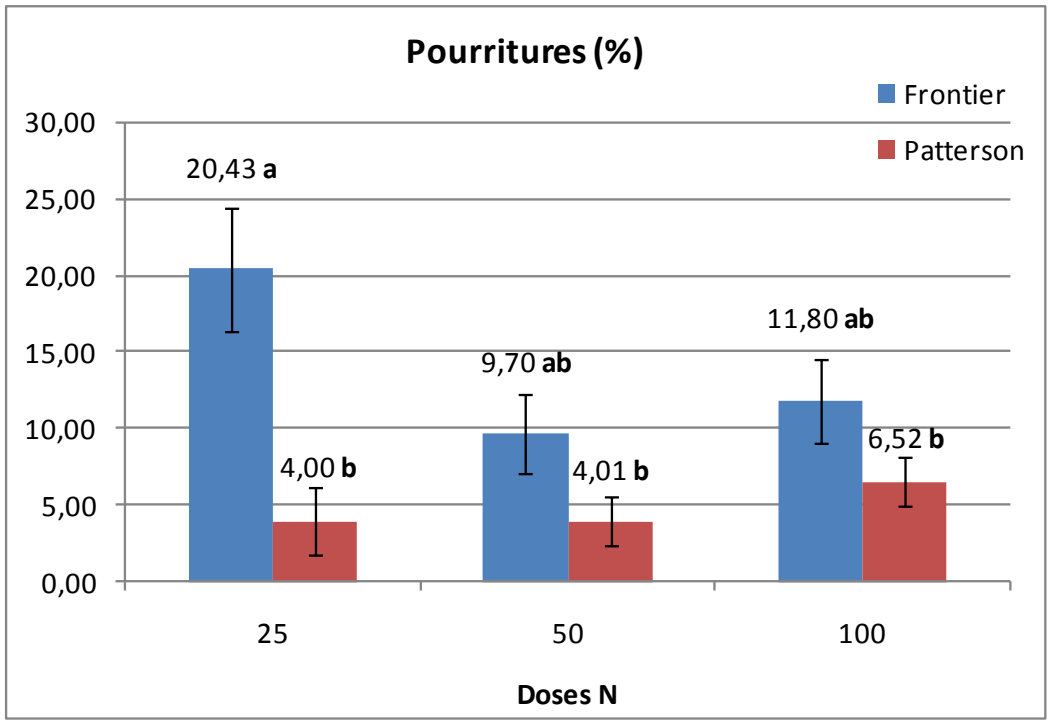


Weight losses per variety vs Nitrogen application rate





Decay losses per variety vs Nitrogen application rate





Post-harvest evaluations

- Higher weight loss on Frontier after storage
- More rot on Frontier (14%) vs Patterson (4.88%)
- Rot percentage on Patterson increase with Nitrogen rate, not on Frontier



2014

- **Sherrington, Qc (Vert Nature Inc.) :**
  - **2 sites with same methods as for 2012**
    - **Frontier vs Patterson**

- **Bradford, On (Hillside Farms)**
  - **1 advanced site**
    - **Stanley (1 variety only)**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