Chickpea, Faba bean & Lentil
UPDATE - 2018

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Chickpea Breeding
Objectives:
• Yield
• Resistance to ascochyta blight
• Early maturity
• Improve weed management
• Seed Quality (size, shape and colour)
• Processing/canning
• Nutritional quality

2018 SK Seed Guide
Characteristics of Chickpea Varieties

<table>
<thead>
<tr>
<th>Market class</th>
<th>Variety</th>
<th>Years Tested</th>
<th>Yield (% Amit)</th>
<th>Ascochyta Blight</th>
<th>Days to Flower</th>
<th>Maturity</th>
<th>Seed Weight (g/1000)</th>
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</thead>
<tbody>
<tr>
<td>Kabuli</td>
<td>Amit (B-90)**</td>
<td>16</td>
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<td>M</td>
<td>271</td>
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</tbody>
</table>

Candidates for 2019 release
(Prebreeder seed increase: W2018 – Arizona; S2018 – SK)

- Similar package to CDC Orion
  - 160g/1000 seeds AB = 4.8 (2015)
  - 158g/1000 seeds AB = 4.2 (2015)

- Variety 1748-1
  - 400g/1000 seeds AB = 4.4 (2015)
  - AB = 4.2 (2015)

- Variety 1814-2
  - 2770-1

- Variety 3662
What's new in 2018:

Ramping up Regional Test: 36 entries/year
(New: 22 kabuli & 5 desi)

→ Allows more stringent selection

Pre breeder seed development
• 4 entries - bulk increase
• 8 entries - long plots
• 14 entries – micro plots

FABA BEAN BREEDING

Objectives:
• Maintain, improve yield
• Develop low vicine/convicine small-seeded zero-tannin cultivars;
• Develop low vicine/convicine large-seeded food type faba bean cultivars;
• Improve resistance to chocolate spot disease;
• Develop early maturing cultivars;
• Improve lodging resistance;
• Develop germplasm lines for use in future faba bean genetic improvement

Reducing seed size

Tannins: associated with flower colour

Tannins (polyphenolics) → Concentrated in seed hulls
Eliminated by either of 2 genes zt1 or zt2
Co-expressed as white flower

Seed coat of white flower type:
0 to 0.6 % tannin
→ better digestibility of protein
and a higher proportion of available energy

Zero tannin – 310 mg
Normal tannin – 700 mg

Seed coats of coloured flower type: 4 to 8 % tannin
Vicine & Convicine:
Glucopyranosides in cotyledons of fresh and dry seeds
- Resist thermal treatment
- Generate aglycones (divicine and isouramil) in digestive track, which then enter blood
- Induce favism (acute hemolysis) in genetically susceptible individuals
- ANF significantly reducing producing performance of laying hen and chicken
- Genotype with low vicine/convicine is available!

Faba Bean CDC 219-16 – small seeded, white flower
- CDC 219-16 - closes the yield gap with CDC Snowbird, but retains small seed size
- Still have to deal the vicine/convicine issues
- All future white flowered types from CDC will be low vicine…..this takes time and resources
- Need to use PBR as a quality management tool

Faba Bean CDC 219-16 – small seeded, white flower

<table>
<thead>
<tr>
<th>Entry</th>
<th>Yield kg/ha</th>
<th>% Snowbird</th>
<th>Flower Colour</th>
<th>Seed weight g/1000</th>
<th>Height cm</th>
<th>Lodging (1-9)</th>
<th>Days to flower</th>
<th>Days to mature</th>
<th>Lodging: is a (1-9) rating where 1 - no lodging and 9 - completely lodged</th>
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<tbody>
<tr>
<td>Snowbird</td>
<td>4630</td>
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<td>W</td>
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<td>92</td>
<td>3.2</td>
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<td>117</td>
<td></td>
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</tbody>
</table>

[X] Number of site-year. W - white

- Not low vicine/convicine!
Reminder:
• Outcrossing potential;
• ~1 km isolation is required for pedigreed seed production

The world of faba bean has changed after 40 years of neglect.....

• Reduced demand for pea and lentil?
• Production push for faba bean changed to market pull
• Demand for plant protein
• Marker for low vicine gene changes the game, all over the world...
• Increased effort for disease resistance, drought tolerance
• Unparalleled crop rotation benefits due to nitrogen, resistance to Aphanomyces and root system
Faba Bean

Current focus of genetic research and variety development

• Rapid transition to 100% low vicine
• Chocolate spot
• Drought tolerance?
• Nutritional profiles
• Yield improvement
• Protein per acre

Goals/Concerns in Lentil Breeding

• GOALS
  • Lower production cost
  • Increase yield and stability
  • Grower satisfaction – disease resistance, lodging, herbicide tolerance
  • Consumer satisfaction – colour, appearance, nutrition, cost

Rapid introduction of new technologies and ideas that allow us to increase/maintain genetic AND economic gains

Concerns: Crop competition, lack of valued-added processing, currency, transportation …and

• INADEQUACY OF CRITICAL INFRASTRUCTURE – most critical are growth facilities and storage facilities
• LACK OF RESPECT FOR INTELLECTUAL PROPERTY RIGHTS of PLANT BREEDERS under UPOV ’91 (domestic and global)

Crop Kind: Lentil

Market Class: Large green (imidazolinone tolerant)

Variety name: (Registration Test ID: IBC 937 - name to be confirmed)

Yield advantage: higher yield than CDC Impower

Maturity rating: Same as other large greens

Disease ratings: Very good for ascochyta

Quality attributes: Large seed, colour between CDC Plato and Greenland

Year of Registration/Release: 2018 (lots of seed)

Summary of agronomic performance: 2015 - 2017 Lentil Regional Variety Trials

<table>
<thead>
<tr>
<th>Market class</th>
<th>Line</th>
<th>Variety</th>
<th>Yield (kg/ha)</th>
<th>Market</th>
<th>Seed weight (g/1000)</th>
<th>Days to flower (1-5)</th>
<th>Days to mature (1-5)</th>
<th>Lodging height (cm)</th>
<th>Plant height (cm)</th>
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</thead>
<tbody>
<tr>
<td>SR</td>
<td>CDC Maxim</td>
<td>2261</td>
<td>100</td>
<td>MC-C</td>
<td>38</td>
<td>55</td>
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</tbody>
</table>

[ ] indicates number of sites

Market Classes: SR - small red; LG - large green
Crop Kind: Lentil
Market Class: Extra small red
Variety name: CDC Rosie (Registration Test Id: IBC 978)

Yield advantage: competitive with CDC Maxim (Zone 1 and 2)
Maturity rating: Early to medium
Disease ratings: Good for ascochyta and anthracnose
Quality attributes: plump gray seeds
Other agronomic traits: Tall extra small red
Year of Registration/Release: 2018

<table>
<thead>
<tr>
<th>Market Class</th>
<th>% of weight</th>
<th>Days to flower</th>
<th>Days to maturity</th>
<th>Lodging</th>
<th>Plant height (cm)</th>
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<tr>
<td>SR CDC Maxim</td>
<td>2261</td>
<td>100</td>
<td>38</td>
<td>96</td>
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</table>

[1] indicates number of sites
Market Classes: SR - small red; ESR - extra small red;