Chaff cover holds advantages under high temperatures during planting

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Planting in the Northern Cape normally takes place between the beginning of January and the beginning of February. The long term air temperatures during this period varies between a minimum of 10.68°C and a maximum of 36.75°C. These temperatures lead to soil temperatures of up to 40.7°C in the upper 10 cm. The emergence and early growth of potatoes are negatively influenced by temperatures above 24°C, Midmore (1984). The delay in emergence can delay the start of tuber initiation, although it will not limit initiation. With the high temperatures experienced, it was found that emergence could easily take between 21 and 28 days after planting. A further complication of the delayed emergence of the potatoes is the fact that the official advent for frost in the area is 20 April. This leads to a growing period of only 55 to 70 days which suppresses the yield potential of potatoes.

Burgers and Nel of the University of Pretoria published an article in 1984 on the impact of irrigation and the use of chaff cover on water usage by potatoes. The application of 14 ton chaff per hectare led to a lowering effect on soil temperatures and an increase in tuber yield throughout. Soil temperatures under the chaff cover were at times up to 10°C lower as at the uncovered control sites. In terms
of all irrigation levels, the chaff covered sites on average produced 30% more tubers than the control sites.

Based on the above, a study was started in 2010 to investigate the possibility to simulate early emergence by making use of a wheat chaff cover on the planting rows. The advantages of early emergence are lowering the incidence of seed potatoes rotting and extending the growing season.

Figure 2. Soil temperature at a depth of 10 cm (A) and 20 cm deep (B) of the sites covered with 2 t/ha chaff compared to the control sites not covered with chaff.
Methods

Potatoes were planted on the farm Berea of Mr Jan Steenkamp in the Douglas district. The plantings were done on sandy soil under central pivot conditions. Sites were planted by hand and the rows were thereafter covered with about two ton chaff cover per hectare (Figure 1). Temperature probes were installed to measure the temperature at different depths. The date of emergence and the growth during the season as well as the yield and tuber size distribution were measured over four years.

During the 2010 to 2013 seasons an additional 46 kg N/ha where applied to off-set the possible nitrogen negative effect of the chaff. The chaff was visible for most part of the season, but by harvesting time most of the chaff had already disintegrated. The co-worker follows a regular spaying program throughout the season and no negative impact on diseases was observed.

Results

Soil temperature
The chaff cover had a positive effect on soil temperature and the maximum temperature of the soil at a depth of 10 cm was up to 5°C cooler as at the control sites (Figure 2). The temperature variation between the minimum and the maximum was also lower at the chaff covered sites as at the control sites.

Emergence and growth of potatoes
Over the four years it was found that at the sites covered with chaff the potatoes emerged faster and more homogeneously compared to the sites that were not covered.

Yield
The chaff cover showed a positive reaction on the potato yield over the four seasons (Figure 3). The chaff cover showed a yield increase of about 12.7% compared to the control. The application of additional nitrogen showed a further 11.1% increase.

Tuber size
The size group distribution of the potatoes was determined every season and is summarised in Figure 4.

The chaff cover had a positive impact on the size group distribution of the potatoes and the number of large and medium sized tuber were higher with the chaff covering compared to the control. Although the application of additional nitrogen benefitted the large and medium potatoes, it had the biggest impact on the number of small potatoes.

Summary
The use of chaff as covering for potatoes held definite advantages. The soil temperature during the emergence phase was lower and the plants emerged quicker. The yield and size group distribution were higher compared to the control. The application of additional nitrogen to off-set the negative effect of the chaff, held a further advantage.

The concept of a chaff cover is applied commercially in the Northern Cape, especially on early generation plantings. Because the physical application of the chaff is a challenge, GWK has developed equipment for this purpose.

Table 1. Results of four trials in which the effect of chaff covering was tested on the date of emergence compared to the control (without chaff cover).

<table>
<thead>
<tr>
<th>Planting</th>
<th>EMERGENCE (Days after planting)</th>
<th>Frost</th>
<th>Harvesting</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Without chaff cover</td>
<td>With chaff cover</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>2 Feb 29</td>
<td>18</td>
<td>21 May</td>
</tr>
<tr>
<td>2011</td>
<td>3 Feb 28</td>
<td>16</td>
<td>28 April</td>
</tr>
<tr>
<td>2012</td>
<td>7 Feb 20</td>
<td>16</td>
<td>15 May</td>
</tr>
<tr>
<td>2013</td>
<td>30 Jan 29</td>
<td>19</td>
<td>4 May</td>
</tr>
</tbody>
</table>
Figure 3. The effect of a chaff cover on the potato yield.

![Graph showing the effect of chaff cover on potato yield]

Figure 4. The impact of a chaff cover on the size group distribution of potatoes (average for three seasons)

![Graph showing the size distribution of potatoes]

KV = 1.85%, p = 0.000. KBV (0.05) = 1.47 t/ha

Sources

