A. PROGRAMME & PROJECT LEADER INFORMATION

<table>
<thead>
<tr>
<th>Programme leader</th>
<th>Project leader (Researcher)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title, initials, surname</td>
<td>Dr MI Ferreira</td>
</tr>
<tr>
<td>Present position</td>
<td>Specialist Agricultural Scientist</td>
</tr>
<tr>
<td>Qualification</td>
<td>PhD</td>
</tr>
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<td>Corresponding Author</td>
<td>Yes</td>
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</tr>
</tbody>
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B. PROJECT PURPOSE

<table>
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<tr>
<th>Research</th>
<th>Training</th>
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C. PROJECT INFORMATION

<table>
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<tr>
<th>Project title</th>
<th>Weed suppression with smother crops in small grain cropping systems of the Western Cape</th>
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<tbody>
<tr>
<td>Keywords</td>
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<tr>
<td>Start date</td>
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</tr>
<tr>
<td>End date</td>
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1. Problem identification, objectives and aims

A combination of pressures, namely herbicide-resistant weeds, environmental concerns and cost containment, has prompted interest in new weed control measures. By broadening the array of weed management options available, it is hoped that producers will manage these pressures more effectively. As pioneering plants, weeds have a great ability to adjust to environmental changes. Current management and production practices have created a more favourable environment for weeds. Weed management is a critical issue in conservation farming and sustainable agriculture because controlling weeds is intimately linked to two of the greatest sources of environmental pollution associated with crop production: soil erosion and herbicide contamination of water resources.

Addressing issues like herbicide-resistant weeds, environmental concerns and costs with agronomic strategies, points to Conservation Agriculture, which aims at harnessing the abundant and diverse life forms that exist within soils to enhance its long-term productivity. Included in this strategy, as proposed by the FAO of the United Nations, is the use of smother crops.

Using a smother crop is thought to suppress weed density and to add other beneficial effects in sustainable agricultural systems. The term refers to a dense-growing crop that suppresses or stops the growth of other plants, especially weeds. The adoption of smother crops as part of normal agricultural practice can benefit sustainable agriculture and be part of an integrated weed management system.

It is believed that this research will add to improving grain production systems in the broader mission of the research strategy of the National Department of Agriculture to guide and direct the generation, adaptation and application of knowledge and innovation for sustainable agricultural development to benefit society.

The aim of this research project will be to study the interactions of two smother crops on weeds, using mustard and oats, on the population of natural weed infestations. In addition, the effects of smother crops on pests and diseases will also be studied. The major goal of this research will be to provide grain producers with scientific information on how to grow smother crops in an integrated weed management system, reducing herbicides, fungicides and insecticides use and consequently contribute to sustainable agriculture.

2. Rationale (motivation) - Hypothesis

According to Storkey (2008), successful long-term weed management requires a shift from simply controlling problem weeds with in-crop herbicides to agricultural production systems that are redesigned to manage weeds at all stages of their life cycle. Such systems should restrict weed emergence, reduce weed growth and reproduction, and minimize weed competition with crops. Research in the last decade has documented that management practices such as reduced tillage, diverse crop rotations, competitive cultivars, higher crop seed rates, altered seed dates, specific fertiliser placement and timing, intercropping, silage crops, and green manure or cover crops can effectively manage weed populations, especially when used in conjunction with targeted, but limited herbicide use. Research has also clearly indicated that the effectiveness and consistency of these non-herbicide weed management practices greatly increases when three or more of these practices are
Simultaneously employed. Once these integrated weed management systems are implemented, herbicides can then be used in a more targeted and sustainable manner, preserving their usefulness for decades to come (Storkey, 2008).

Farmers can attain higher levels of productivity and profitability through improving soil health and the environment. These outcomes can be achieved through the adoption and implementation of conservation agriculture principles and practices. Agronomic strategies for conservation agriculture aim at harnessing the abundant and diverse life forms that exist within soils to enhance their long-term productivity. Some combinations are:

- Non-inversion weed control, including the use of allelopathy and smother crops;
- Increase in biomass inputs to soil systems;
- Ecosystem-based and integrated management methods to control weeds, pests and diseases (United Nations FAO, 2008).

Of the combinations mentioned above, the use of allelopathy is covered by ongoing research on this topic, which has been conducted at The Department of Agriculture Western Cape since 2003. Initial results from 2008-2011 on smother crop research are promising and it is planned to repeat these for demonstration at farmers’ days in 2012. This research on smother crops will also encompass other combinations proposed by the FAO, namely increased biomass and integrated management of weeds, pests and diseases.

Smother plants are specialised cover crops being investigated for their ability to suppress weeds. Besides offering an alternative method to combat weeds, smother plants can reduce soil erosion and improve soil quality. In the past, researchers have suggested that if annual weeds can be suppressed for four to six weeks by a smother plant, crop yields may not be reduced by weed infestations (leopold.iastate.edu/research/grants/1999/1996-03_Spring_Seeded_Smother_Crops).

Smother cropping is cover cropping with competitive species in an attempt to starve weeds of light, nutrients, moisture and space. Smothering can weaken weeds by depleting their carbohydrate reserves and can lessen weed pressure by slowing growth and reducing seed production. Fast-growing, high-biomass species make good smother crops because they can get a head start on weeds (Grubinger, 2002). In addition, cover crops can improve the soil by adding organic matter, nutrients and stability and by acting as scavengers to trap excess nutrients that otherwise might leach out of the soil (cropsoil.psu.edu/extension/ct/uc128.pdf). It also builds soil organic matter and provides a way to build up mineral and soil biological levels, setting the stage for a few years of excellent crops. Substituting a year of cash crops in a rotation with smother crops, does break weed cycles (Zimmer, 2003) and reduces weed numbers in following years for improved herbicice efficacy.

According to Buhler (1997), a successful smother crop system must have at least three key characteristics: flexibility, consistency, and adaptability. Other important aspects include life cycle, seeding date and rate, winter hardiness, nitrogen fixation or scavenging ability, feed or forage value, and establishment costs (cropsoil.psu.edu/extension/ct/uc128.pdf).

One of the major impacts of this project will be the opportunities provided at farmer’s days to introduce the concepts of plant interference-based pest, disease and weed management systems to a broad audience. The feedback and suggestions obtained at the major cropping systems’ farmer’s days of the Western Cape will refine cultivation of smother crops to eventually make a contribution to integrated plant protection for improved conservation farming and sustainable crop production.
3. **Literature review**

See below

4. **Potential beneficiaries**

The knowledge gained in this study will further our capacity to structure environmentally friendly plant protection practices, which will typically be applicable to small-scale crop, vegetable and fruit farmers.

5. **Technology development**

Introduce the concept of smother crops’ cultivation as a plant interference-based weed management system, at farmer’s days from 2012-2017. The production practice of smother cropping for herbicide resistant weed control may be easily incorporated into existing crop rotation systems as the same planting equipment and techniques may be used. No agricultural chemical spraying or fertilisation is required. The only managerial decision to be made will be to increase the crop rotation system from four to five years, with the additional year set aside for smother cropping after wheat cultivation. Ten weeks after planting, the smother crop could either be used as a pasture crop or cut and rolled during September to form plant residue mulches into which the normal rotational crops will be planted no-till the following year.
## Persons participating in the project (list internal and external collaborators)

<table>
<thead>
<tr>
<th>Surname and initials</th>
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<th>Highest qualification</th>
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<th>Disabled</th>
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<tbody>
<tr>
<td>Ferreira, MI</td>
<td><a href="mailto:mikefe@elsenburg.com">mikefe@elsenburg.com</a></td>
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<td></td>
<td>11</td>
<td>W</td>
<td>M</td>
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<td>Plant Science, Agriculture</td>
<td>PrL</td>
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<tr>
<td>Z Sedeman</td>
<td><a href="mailto:zanes@elsenburg.com">zanes@elsenburg.com</a></td>
<td>Matric</td>
<td></td>
<td>8</td>
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<tr>
<td>K Laubscher</td>
<td><a href="mailto:kobusl@elsenburg.com">kobusl@elsenburg.com</a></td>
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<td>PhD</td>
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(1) Race:  
B = African, Coloured or Indian  
W = White  
(2) Gender:  
F = Female  
M = Male  
(3) Position:  
Co = Co-worker (other researcher at your institution)  
Coll = Collaborator (participating researcher that does not receive funding for this project from industry)  
PF = Post-doctoral fellow  
Pr L = Programme leader  
PL = Project leader  
RA = Research assistant / student  
TM = Team member  
TA = Technical assistant / technician
### Budget for the first year:

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Appendix A

3. Literature review


