

### 3. FINAL RECOMMENDATIONS

The constraints, identified by the farmers and recorded during both the survey and with the questionnaires, are summarised in the below diagram. Some constraints were also raised during the Mid-term Workshop. It is striking from the diagram that the most important constraints recorded during the survey were those that fell into the pre-harvest category. This was because there was no restriction placed on obtaining any particular category of constraints. This of course was not the case with the questionnaires, where the respondents were most certainly restricted to post-harvest constraints. Although some post-harvest constraints were mentioned during the survey, they were rather swamped by pre-harvest issues.

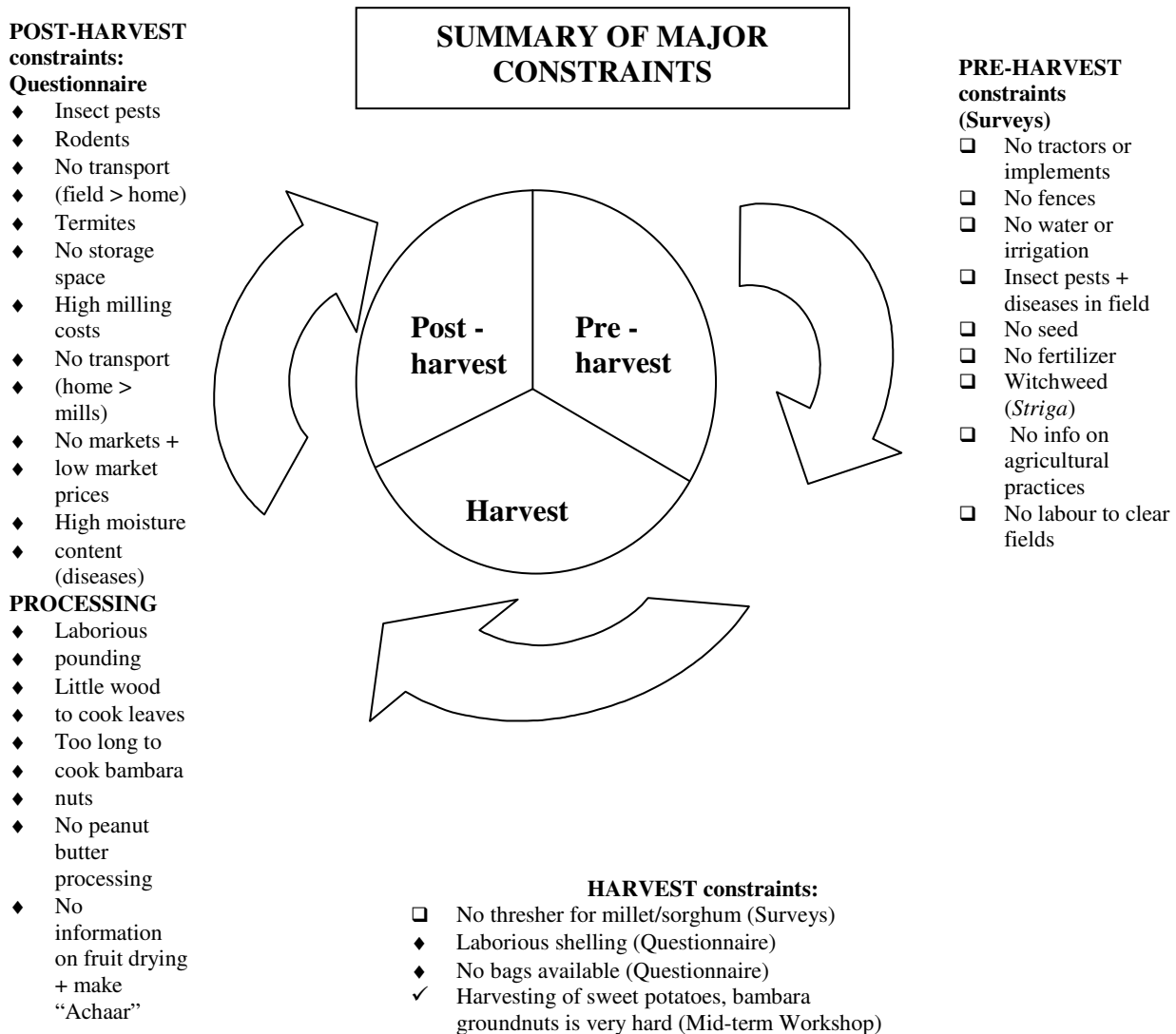


Figure 3.1 Summary of major constraints

The constraints, depicted in the Figures below in a series of histograms, are based on the analyses of the village questionnaire data collected from villager interviews. They are arranged in descending order of frequency and importance. What is striking with the grain crops, however, is that the first 3 constraints remain consistently the same, namely, (1) pests > (2) rodents > (3) no transport (field to home). With all the other crops, this pattern does not change except that the (2) constraint of rodents is taken up by other constraints. It is evident that different constraints face, for example, those farmers growing Njugo beans, cowpeas, and legumes, where high moisture content, accompanied by drying problems, and processing problems come into the fore. Besides insect pests, drying problems are the second-most serious constraint with the vegetable farmers. Finally, constraints facing the fruit farmers are in a class of their own, with the lack of markets being the second-most important constraint. Fruit rotting on trees, premature fruit drop and theft are the major constraints here.

## Crop post-harvest constraints ranked in descending order of frequency and importance

Figure 3.2

**Ranked post-harvest MAIZE problems experienced by 128 farmers growing maize as their staple crop in the Northern Province, South Africa.**

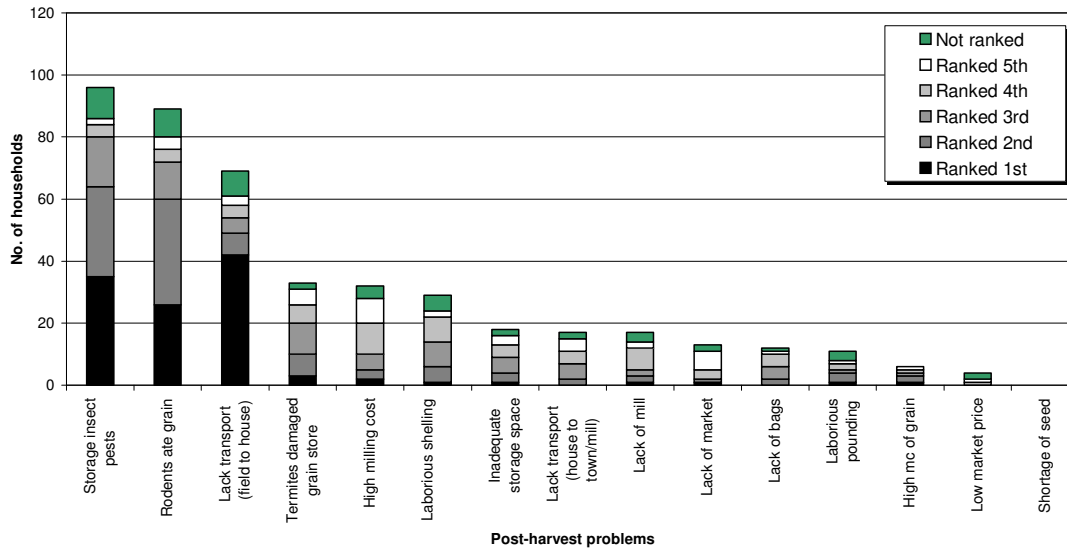


Figure 3.3

**Ranked post-harvest SORGHUM problems experienced by 40 farmers growing sorghum as their major staple crop in the Northern Province, South Africa.**

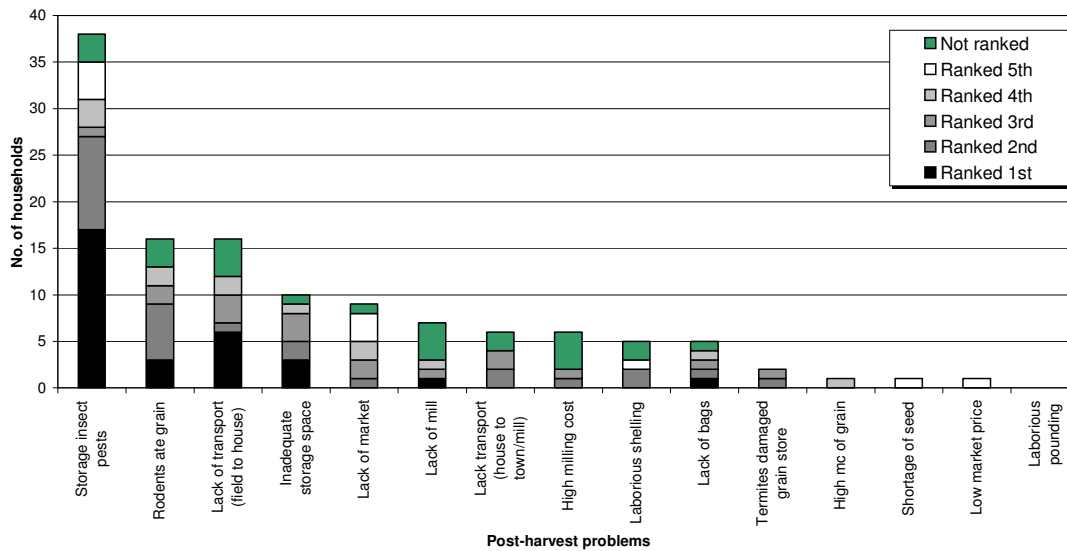


Figure 3.4

**Ranked post-harvest MAIZE and SORGHUM problems experienced by 6 farmers growing both maize and sorghum as their staple crop in the Northern Province, South Africa.**

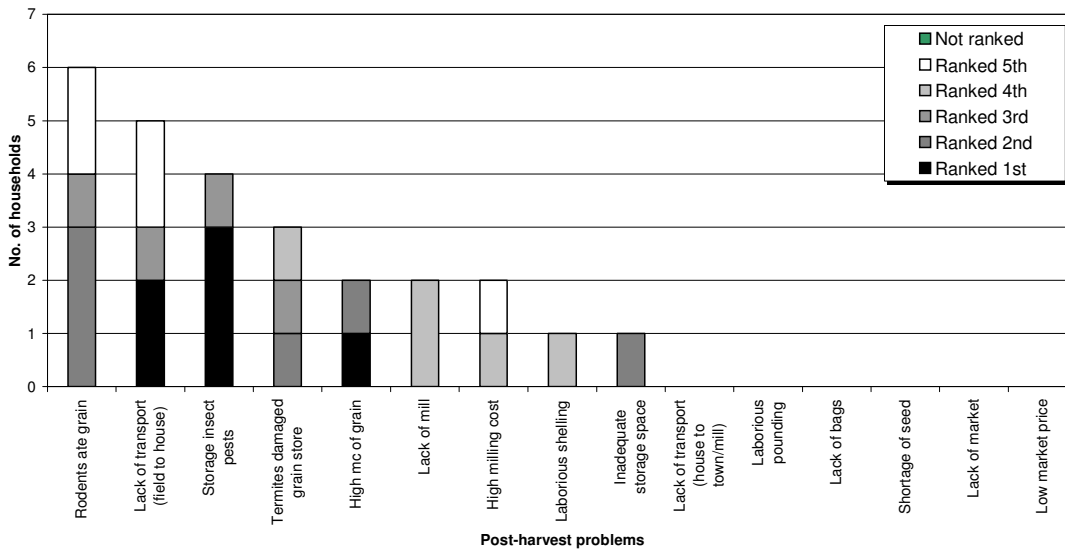


Figure 3.5

**Ranked post-harvest PEARL MILLET problems experienced by 5 farmers growing pearl millet as their staple crop in the Northern Province, South Africa.**

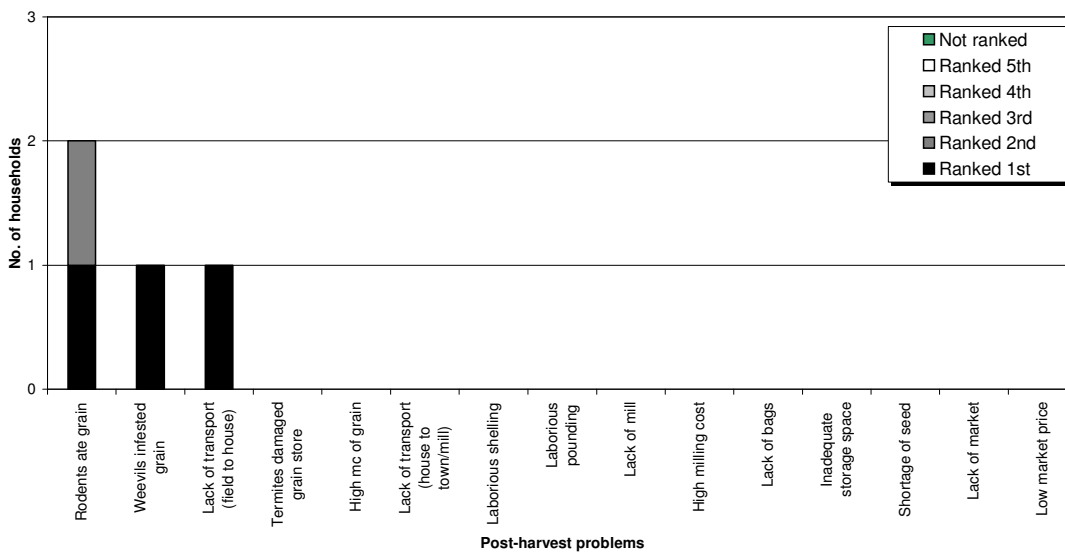


Figure 3.6

**Ranked post-harvest GROUNDNUT problems experienced by farmers in the Northern Province, South Africa.**

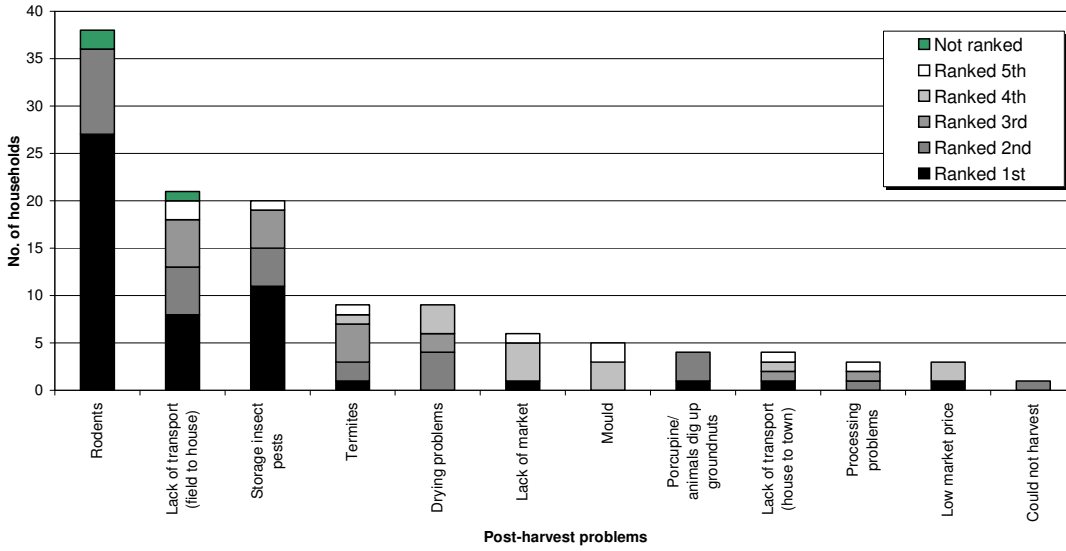


Figure 3.7

**Ranked post-harvest NJUGO BEANS, COWPEAS and OTHER LEGUMES problems experienced by farmers in the Northern Province, South Africa.**

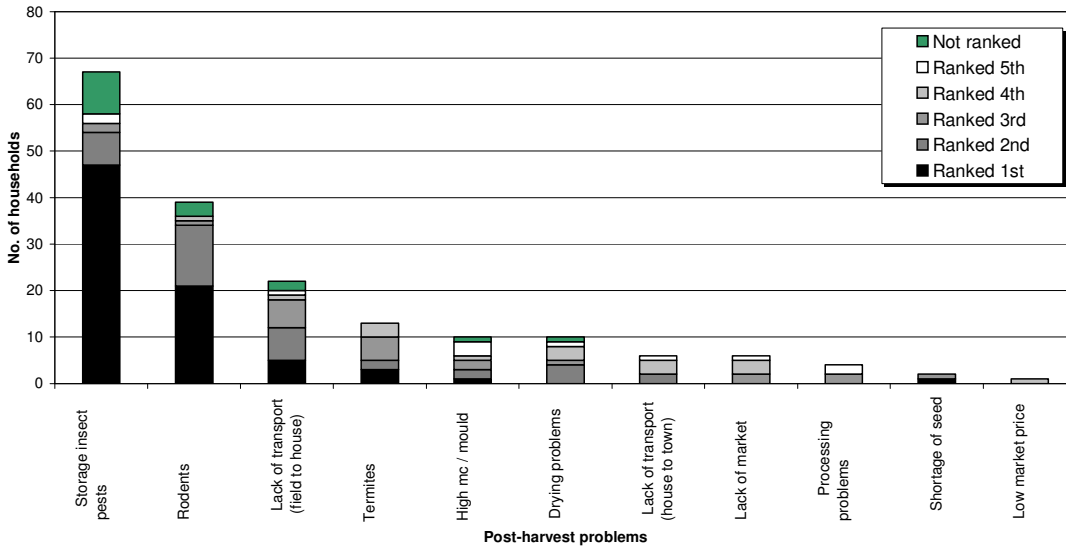


Figure 3.8

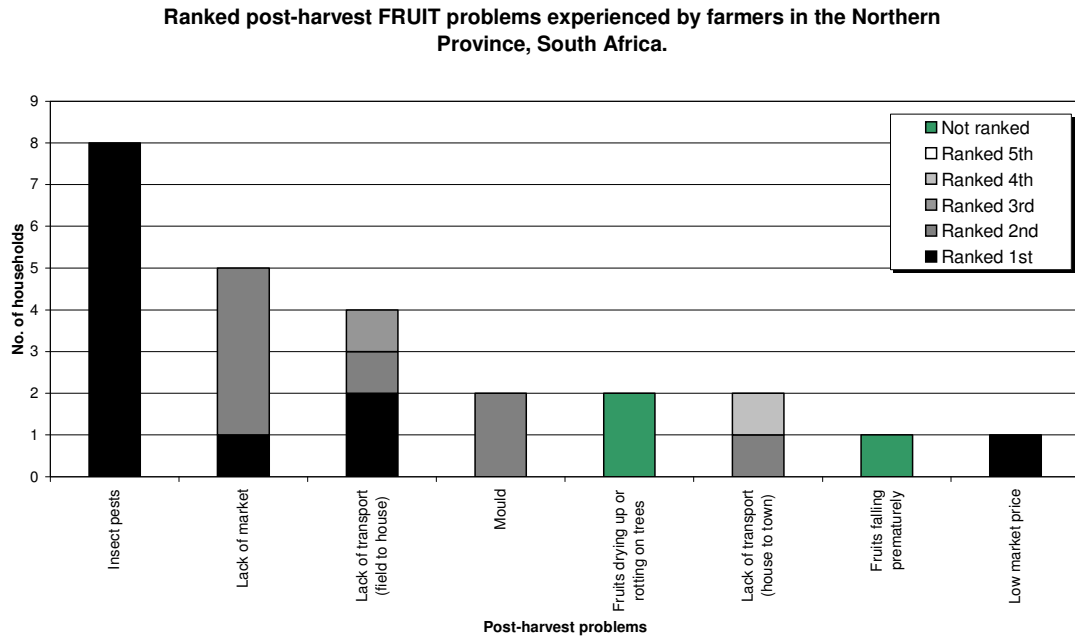


Figure 3.9

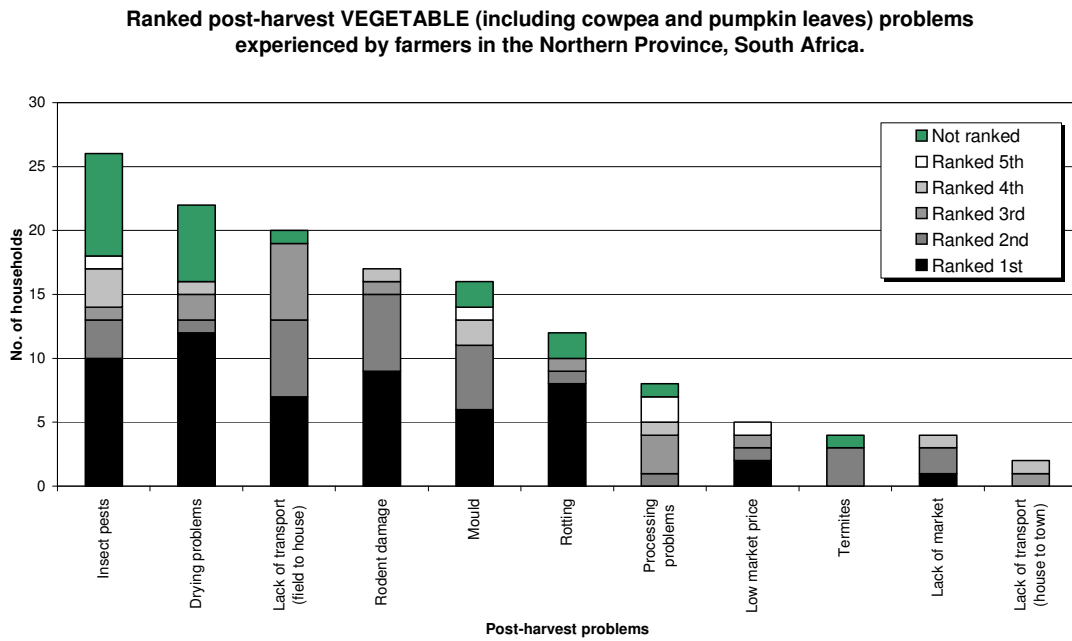
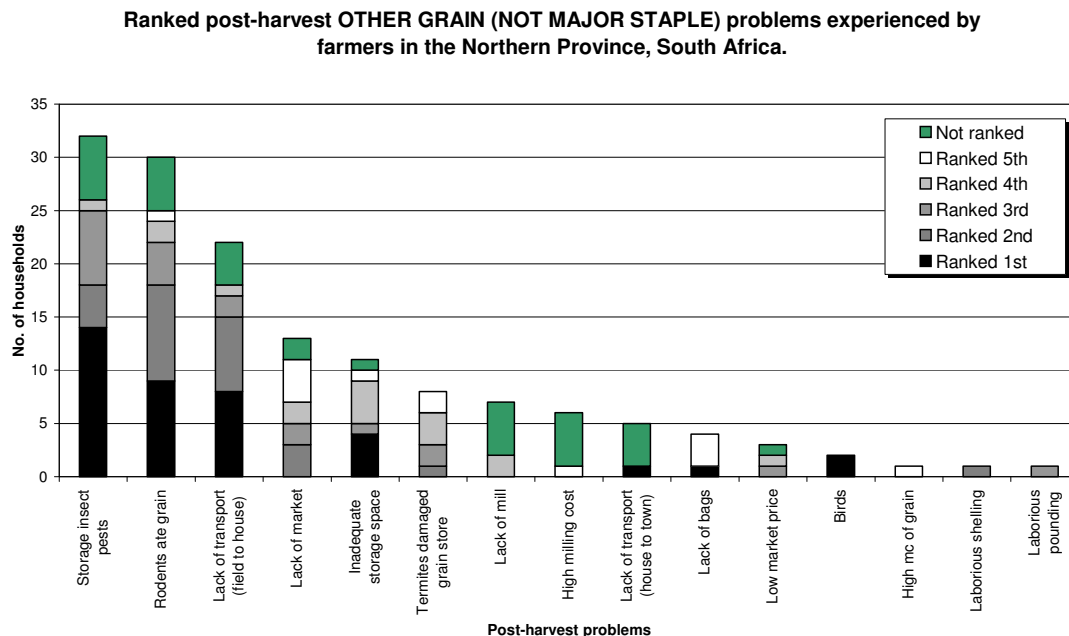


Figure 3.10



The post-harvest constraints obtained from the questionnaire histograms (Figs. 3.2 to 3.10) are listed more or less in descending order in the first column of Table 3 below. Figs. 3.2 to 3.10 show how the order of constraints varies from crop to crop, but Table 3 should be consulted for more information on those constraints. Some constraints mentioned at the Mid-term Workshop are also included in Table 3.

Table 3 . Summary of constraints and corresponding possible approaches for addressing the constraints

<i>Questionnaire constraints (see histograms above)</i>	<i>Survey constraints (see Table 2.4.3 )</i>	<i>Possible approaches/information/research outputs for addressing Constraints</i>	
		<i>Mid-term Workshop Suggestions</i>	<i>CPHP Outputs</i>
1. Storage insect pests (insect weevils etc)	Was in about 7 <sup>th</sup> position, mentioned by all villages except Nkomo-B & Mapate	<ol style="list-style-type: none"> <li>1. "Can granaries be made airtight so that phosphine gas can be used effectively?</li> <li>2. Wider dissemination of aloe ash admixture? Can its insecticidal persistence be improved beyond 3 months? (but NTK Co-op does not like to receive seed + ash). Investigate use of traditional plant material that kills or repels insect pests (e.g. monze branch)? (Use also registered pesticides)</li> <li>3. Screen various types of dust?</li> <li>4. Paraffin is also mixed with harvested seed to protect against insect pests.</li> <li>5. Good pre-harvest crop hygiene measures + good storage management principles (hygiene, drying, maintenance etc) training course.</li> <li>6. Larger Grain Borer presence in the Northern Province: take measures to prevent LGB take-over" <b>ARC-PPRI</b> is monitoring spread of LGB from Kruger National Park</li> </ol>	<p><b>Project R6052</b> (Mud-based silos: farm stores for cereals)</p> <p><b>Project R7373</b> (Understanding the mechanisms of bioactivity in botanically-derived material to protect stored grain in farm storage systems)</p> <p><b>Project R7034</b> (Grain storage pest management using inert dusts)</p> <p><b>Project R7442</b> (Improvement in the storage and marketing quality of legumes (Phase II))</p> <p><b>Project R6684</b> (Risk warning to farmers of Larger Grain borer infestation and reduced pesticide treatment in farm maize silos)</p>
2. Rodents eating grain	This was in about 10 <sup>th</sup> position, a problem in the Lowveld District & Ga-Phaahla	1. "Use rat traps & reduce the use of dangerous chemicals. Implement rat trap method of Mozambique? (Rattex ® is registered for use against rats but is proving to be ineffective)"	<b>Project R7372</b> (Impact of rodents on rural households in Mozambique and the development of suitable control)
3. Lack of transport (field to home) Donkey carts (maize, legumes) are expensive. Bags carried by women (head), & men (shoulders); wheelbarrows are also used.	This was in about 7 <sup>th</sup> position, a problem in all villages except for Nkomo-B, & Vhurivhuri.	<ol style="list-style-type: none"> <li>1. "Design a wheelbin with 2 wheels that can carry 250 kg of maize &amp; that can be easily pulled from the field to the homes/granaries by women and children"</li> <li>2. <b>ARC-IAE</b> can design a wheelbin which is as cost-effective as possible?</li> </ol>	
4. Termites damaging wood structure of the grain store (also lack of building materials)	This was in about about 7 <sup>th</sup> position, a problem only mentioned by Vhurivhuri & Ga-Phaahla	1. "Suggest using treated poles; aluminium poles, 1-m high (to stop rats), & demonstration models of granaries & farmers visiting leading farmers. Use improved tanks (metal)."	<b>Project R6685</b> (Improved design of indigenous grain stores — including minimising the use of hardwood)
5. No storage space (due to lack of building materials, and no bags available (see (11))	Lack of storage was raised by only Nkomo-B		

<i>Questionnaire constraints (see histograms above)</i>	<i>Survey constraints (see Table 2.4.3 )</i>	<i>Possible approaches/information/research outputs for addressing Constraints</i>	
		<i>Mid-term Workshop Suggestions</i>	<i>CPHP Outputs</i>
6. High milling costs	The distance & transport to the mill was raised by Basani & Mapate	1. "ARC-IAE & ARC-GCI have small-scale mills that might be appropriate for these communities & who could test different models"	
7. Laborious shelling. This badly injures the hands	Was raised only by Mapate	1."ARC-GCI demonstrated a manual sheller which costs R2 to make. These could be produced locally." 2. "Some communities may also be interested in mechanical shellers, which ARC-GCI could provide for testing".	
8. No mills available	Was mentioned by BB-kloof women		
9. Lack of transport (home to mills/town)	Was mentioned by Mapate & BB-kloof men		
10. No markets available + low market prices (also "No transport available to reach markets. No incentive to sell & no knowledge of markets.")	Was about 11 <sup>th</sup> , & was raised by Vhurivhuri and Southern District	1. "Expanding the markets outside the community (including the big cities). Is there a market for jam and watermelon? Entrepreneurs can sell to canning companies."	<b>Project R6964</b> (Opportunities/ constraints in subsistence production of indigenous vegetables in East & Central Africa, Cameroon, & Uganda. <b>Project R7485</b> (Facilitating the effective production and marketing of processed food products by small-scale producers in Zimbabwe) <b>Project R7581</b> (Marketing & processing of bambara groundnuts (W Africa) <b>Project R6640</b> (Increasing the utilisation of sorghum- & millet-based foods in Tanzania)
11. No bags available for placing storing harvest.	Was not mentioned		
12. High moisture content/rotting/ diseases	The disease constraint was about 4 <sup>th</sup> in importance, but referring to the field situation in all villages except Basani	1. "Dry crop material. (Some work has been done on paddy driers but knowledge about drying practices would be included in any good grain storage course.) 2. Mr T Donaldson said that donors want to know how to improve the mycotoxin situation, thus preventing e.g. throat cancer)." 3. ARC-IAE can assist with solar drying techniques 4. ARC-GCI is involved with a mycotoxin survey of stored products in South Africa.	



Questionnaire constraints (see histograms above)	Survey constraints (see Table 2.4.3)	Possible approaches/information/research outputs for addressing Constraints	
		Mid-term Workshop Suggestions	CPHP Outputs
13. Laborious pounding	Not mentioned		
<p>14. Processing problems</p> <p>14.1 "Not enough wood for cooking vegetable leaves before storage as dried balls"</p> <p>14.2 "Too much time required to cook bambara groundnuts (Hugo/Njugo beans)"</p> <p>14.3 "No peanut butter Processing occurring"</p> <p>14.4 "No information on food processing: skills needed for drying fruit and making "achaar" (type of chutney)"</p>	<p>Not mentioned</p> <p>Lack of information on processing was mentioned by the women of BB-kloof</p>	<p>1. NGO's in Kenya and W Africa have done successful work on low energy burner designs made from clay and they may be able to share their findings (Tanya Stathers)</p> <p>2. "Would peanut butter processing be of interest to the communities? (But this will require increased production)."</p> <p>1. "Explore methods for improving the drying of vegetables and fruits. (ARC-IAE has experience of solar drying equipment &amp; can assist?)."</p>	<p><b>Project R7581</b> (Marketing and processing of bambara groundnuts (W Africa)</p> <p><b>Project R7419</b> (Raising rural family incomes through improved peanut butter processing)</p> <p><b>Project R7519</b> (Pollution and health problems in horticultural production in Harare: The need for improved quality assurance systems)</p> <p><b>Project R7528</b> (Improved quality assurance systems for fruits and vegetables produced by peri-urban resource-poor farmers in Zimbabwe)</p> <p><b>Project R6964</b> (Opportunities/constraints in subsistence production of indigenous vegetables in East &amp; Central Africa, Cameroon, and Uganda)</p> <p><b>Project R7485</b> (Facilitating the effective production and marketing of processed food products by small-scale producers in Zimbabwe)</p> <p><b>Project R6640</b> (Increasing the utilisation of sorghum- and millet-based food in Tanzania)</p> <p><b>Project R7581</b> (Marketing and processing of bambara groundnuts (W Africa)</p>

<i>Pre-harvest constraints</i>	<i>Survey constraints (see Table 2.4.3 )</i>	<i>Possible approaches/information/research outputs for addressing Constraints</i>	
		<i>Mid-term Workshop Suggestions</i>	<i>CPHP Outputs</i>
<b>UNRANKED POST-HARVEST CONSTRAINTS MENTIONED AT MID-TERM WORKSHOP</b>			
1. "Destruction of harvested crops in field by pests (crops become infested with pests etc and this inoculum is carried into the home or granary") 2. "No access to finances"	Insect pests and diseases in the field was about 4 <sup>th</sup> in importance  No reference made	1. This suggests the existence of a labour or resource bottleneck that needs further investigation  2. "Rural farmers (individually) do not get credit because of they don't pay back, their properties will be taken away from them. If we can get all the farmers together, we can pay the money back." Mr Tim Donaldson (Manager: CPHP, NR International) mentioned that savings groups work better than credit groups. He also added that in some countries, maize is considered to be an asset. Farmers deposit the maize in a warehouse, and are then issued with a credit note from the Bank, based on the maize stored).	<b>Project R7197</b> (Small-holder credit: roles of farmers, government, and private sector) <b>Project R7798</b> (Maximising incomes from sweet potato production as a contribution to rural livelihoods)

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		<i>Mid-term Workshop Suggestions</i>	<i>CPHP Outputs</i>
<b>PRE-HARVEST CONSTRAINTS MENTIONED AT MID-TERM WORKSHOP</b>			
1. "No tractors or ploughs. This causes late planting. (Animal draught power is limited because animals are not in a good condition)"	This was the highest constraint that was repeatedly raised by every village	1. "Could plough early & motivate formation of farmers' Co-operatives or Associations (e.g. with possible additional input from private sector). 2. Need to draw up a business plan + information where farmers can obtain financial assistance."	
2. "Soil fertility problems and the management of erosion"	Lack of fertiliser (6 <sup>th</sup> ) was a problem with all villages except Basani & Ga-phaahla	1. "ARC-ISCW and GTZ-BASED programme could assist? Alternatives such as cattle manure and cheap legume inoculants (ARC-PPRI) could be used."	
3. "No fences - wild animals and cattle destroy crops"	This was the 2 <sup>nd</sup> greatest constraint raised by all villages except Mapate		
4. "Lack of irrigation water"	This was about 3 <sup>rd</sup> in importance, and raised by Nkomo-B, Mapate, and women of BB-kloof. A drought was mentioned by Vhurivhuri	1. "Funding required for replacing damaged irrigation pipes/pumps & for drilling for boreholes"	
5. Not raised at Mid-term workshop	Lack of seed (about 5 <sup>th</sup> in importance) was mentioned by all villages except Basani & Ga-Phaahla		

<i>Pre-harvest constraints</i>	<i>Survey constraints (see Table 2.4.3 )</i>	<i>Possible approaches/information/research outputs for addressing Constraints</i>	
		<i>Mid-term Workshop Suggestions</i>	<i>CPHP Outputs</i>
6. "Lack of enough fields for growing crops"	Not mentioned by any villages		
7. "Lack of resources - no labour to weed fields, lack of seed, and the question of correct maize hybrid selection"	Lack of labour (10 <sup>th</sup> ) to fence and clear fields mentioned by Basani only	1. "ICRISAT and CYMMIT evaluate sorghum varieties for pest resistance, & are being tested in a "mother-baby" project by <b>ARC-GCI</b> in the Northern Province in collaboration with <b>NPDAE</b> (Mr Richard Ramugondo).  2. <b>ARC-PPRI</b> can test the susceptibility of these cultivars to attack by storage pests"	<b>Project 7523</b> (Identifying characteristics which influence consumer acceptance of new sorghum varieties)  <b>Project 7430</b> (Rapid screening of maize and sorghum for varietal resistance to post-harvest insect pests)
8. "Lack of knowledge on agricultural practices"	This problem (9 <sup>th</sup> ) was raised by Nkomo-B and BB-kloof	1. " <b>ARC-Roodeplaat</b> (vegetable research) can assist with production practices of indigenous vegetables, and medicinal plants."	
9. "Pests attacking crops in the field: 9.1 Moles eating groundnuts 9.2 Termites attacking maize 9.3 Birds eating sorghum 9.4 Pests such as maize stalk borers, aphids, African bollworm, sorghum midge, sorghum seed feeder 9.5 Diseases on maize 9.6 <i>Striga</i> (parasitic witch weed)"	Wild animal damage (women, BB-kloof);  About 8 <sup>th</sup> , raised by Lowveld District & Ga-Phaahla	" <b>ARC-PPRI</b> is involved in termite research using baits, and can assist" " <b>ARC-PPRI</b> has projects on quelea bird control and can assist "  " <b>ARC-GCI</b> is involved in projects in the Northern Province and can assist"  " <b>ARC-GCI</b> has expertise on maize diseases and can assist" " <b>ARC-GCI</b> has experience in weed management practices and can assist"	
10. "Harvesting problems: 10.1 "Harvesting sweet potatoes, bambara (Njugo) groundnuts is very hard" 10.2 "No threshing machine for e.g. millet/sorghum"		" <b>ARC-GCI</b> said that a groundnut harvester has been patented." (Several groundnut lifters available (peanut diggers)  " <b>ARC-GCI + ARC-IAE</b> can work together with communities to design a prototype machine?"	

<b>INNOVATIVE UPTAKE PATHWAYS FOR CPHP OUTPUTS AS WELL AS OTHER OUTPUTS</b>			
Clearly, farmer involvement/ownership throughout all the stages in any trial is a pre-requisite to the successful solution of any of the farmer's constraints. The importance of farmer-farmer visits as well as learning from similar experiences in e.g. Zimbabwe, where the technologies or practices have already been adopted, cannot be underestimated.			
<i>Pre-harvest constraints</i>	<i>Survey constraints (see Table 2.4.3 )</i>	<i>Possible approaches/information/research outputs for addressing Constraints</i>	
		<i>Mid-term Workshop Suggestions</i>	<i>CPHP Outputs</i>
		<ol style="list-style-type: none"> <li>1. " The extension service should be trained in the relevant technologies so that they can share these with the communities."</li> <li>2. "Extension officers and community workers should be empowered."</li> <li>3. "If extension constraints are severe (such as in Lowveld Region), then the alternative will be to make available to the communities information pamphlet written in the local language and which are easily understood."</li> <li>4. "{Radio to be used to provide information under (2)."</li> <li>5. "Holding of farmers' days on a regular basis."</li> </ol>	<p><b>Project RA0904</b> (Innovative uptake pathways for CPH Programme outputs (Zunde ramambo) system in Zimbabwe)</p> <p><b>Project R7551</b> (Sustainable retailing of post-harvest technology to the poor: Alternative institutional mechanisms for developing &amp; transferring technology</p>

The Mid-term Workshop (MTW) has revealed some recommendations and suggestions as to how these constraints could be addressed. In addition, the relevant CPHP Outputs from neighbouring SADC countries were also presented at the MTW as possible solutions to these constraints. The constraints can be arranged in a series of more or less homogeneous post-harvest constraint clusters shown below. This is accompanied with suggested recommended approaches that would include all the key role players.

### **Constraint cluster 1: Insect pests (including termites), high moisture content, problems with drying, diseases**

1. CPHP Project R6052 on the use of mud-based silos must be thoroughly studied to determine its applicability in the efficacious use of phosphine gas.
2. The efficacy of a variety of botanically-derived pesticides (aloe ash, monze bush etc) as well as the efficacy of registered synthetic pesticides can be studied by e.g. ARC-PPRI in conjunction with CPHP Output 7373.
3. The efficacy of using inert dusts can be investigated according to CPHP Output R7034, possibly using local inert dust deposits. ARC-PPRI could play a role here.
4. To avoid termite damage, the design of indigenous grain stores could be improved (CPHP Output R6685).
5. ARC-IAE for instance can assist in providing technology transfer on solar drying techniques for drying stored products (grain + vegetables) effectively before storage. Other methods of drying could also be investigated by e.g. ARC-Roodeplaat (vegetable research). ARC-GCI may also be able to conduct a survey on the possible incidence of mycotoxins amongst the stored crops of the survey.

### **Constraint cluster 2: Rodents**

1. A technology transfer from CPHP Output R7372 (Mozambique) to village on-farm trials could be envisaged. ARC-PPRI could play a role here. Different granary structures (CPHP Output R6685) could help here to prevent rodent entry.

### **Constraints cluster 3: Agricultural engineering approaches**

1. The constraint of transport from the field to the home was consistently third in its importance. ARC-IAE could help design together with the community a low-cost 2-wheel bin for transporting the harvested crop from the field to the home.
2. Mobile milling equipment needed, and ARC-IAE could test different models on-farm.
3. Mechanical shellers and threshers could be tested/developed on-farm by for instance ARC-IAE and ARC-GCI.
4. Peanut diggers for groundnuts and bambara nuts could be investigated by for instance ARC-IAE

### **Constraints cluster 4: Processing of foodstuffs**

1. The processing of bambara groundnuts could be addressed using CPHP Output R7581.
2. Peanut butter processing technology could be implemented using CPHP Output R7419.
3. To save fuel for cooking vegetable leaves, low energy burner designs could be obtained from NGO's.

### **Innovative uptake pathways for CPHP Outputs**

These uptake pathways can be submitted to the NPDAE for their consideration. CPHP Outputs RA0904 and R7551 can be of assistance here.

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