



SOUTH AFRICAN BARLEY BREEDING INSTITUTE

**REPORT
to
BARLEY
TECHNICAL
COMMITTEE**

July 2013

OPSOMMING

DIE ONTWIKKELING VAN MOUTGARSKULTIVARS VIR DIE DROëLAND GARSPRODUSERENDE GEBIEDE VAN DIE SUIDKAAP EN DIE BESPROEIINGSGBIEDE VAN DIE NOORDKAAP

Doelstellings en doelwitte vir die moutgarsprogram:

Die ontwikkeling van nuwe moutgarskultivars wat superieur is oor die huidige dominante kultivars ten opsigte van agronomiese, mout en brou-eienskappe en vir siekteweerstand.

Doelwit	Status	Verwysing in verslag
Om opbrengsvlakke betekenisvol te verhoog - bokant die van bestaande kultivars	Bereik	Tabelle 5,6,7,12,13,14,15
Verbeterde vetkorrelpersentasies onder optimale toestande	Bereik	Tabelle 5,6,7,12,13,14,15
Ontwikkeling van kultivars met verbeterde mouteienskappe	Bereik	Tabelle 8,16
Waardetoevoeging tot die saad deur verbeterde siekteweerstand	In proses	

Bykomend tot bovermelde, is hulpbronne ook aangewend ten opsigte van:

- Verkryging van toegang tot nuwe tegnologie en kiemplasma wat benodig word om internasionaal steeds kompetend te bly.
- Doeltreffende monsterring van die produksie omgewing, deur van geskikte lokaliteite gebruik te maak vir die aanplanting van teelmateriaal en buite lokaliteite vir opbrengsproewe.
- Daarstelling van fasiliteite vir die bewaring van ouermateriaal en om generasietyd te verkort

Suidkaap

Nuwe eksperimentele kultivars

Een nuwe kultivar, S12, is verlede jaar eksperimenteel vir hierdie gebied goedgekeur.

Prestasie in Proewe

Ontleding van agronomiese eienskappe van eksperimentele en nuwe potensiële lyne in die LE proef in die Suidkaap

	OPBRENGS	VETKORREL	STIKSTOF
Proefgemiddeld	6338	91.6	1.89
Kontrole (Erica)	6425	88.9	1.91
Ander Kultivars (3)	5831	92.1	1.90
Eksperimentele Kultivars (3)	6335	91.8	1.87
Nuwe lyne (18)	6419	91.6	1.89
Lyne geselekteer vir 2013 proef (9)	6559	93.0	1.88
Vordering: kultivars/kontr (%)	-9.2	3.6	-0.7
Vordering: eksperimenteel/kontr (%)	-1.4	3.3	-2.2
Vordering: nuwe lyne/kontrole (%)	-0.1	3.0	-1.5
Vordering: gesel lyne/kontrole (%)	2.1	4.6	-1.7

Vordering ten opsigte van Siekteweerstand

Goeie vordering word ten opsigte van weerstand teen blaarvlek gemaak. Van die 46 lyne wat vanjaar in die Elite 3 proewe is, het 40 totale weerstand teen hierdie swamsiekte. Lyne met redelike goeie weerstand teen netvlek (net tipe en koltipe) en blaarvlek is ook geïdentifiseer en in die teelouergroep ingesluit en heelwat kruisings met die oog op weerstand teen hierdie twee swamsiektes is gemaak. Seleksie in al die filiale generasies was ook baie streng met die oog op weerstand.

Besproeiingsgebied

Die hektare van Cocktail neem steeds toe hoofsaaklik as gevolg van 'n groter aanvraag deur SAB. Marthe is vir die derde jaar as eksperimentele kultivar ge-evalueer, en die brouproewe lyk baie belowend, terwyl Cristalia is sy eerste jaar van evaluasie was.

Ontleding van agronomiese eienskappe van eksperimentele en nuwe potensiële lyne in die LE proef onder besproeiing

	OPBRENGS	VETKORREL	STIKSTOF
Proefgemiddeld	8650	96.2	1.77
Kontrole (Cocktail)	9242	94.5	1.71
Eksperimentele Kultivar (2)	8600	96.0	1.81
Nuwe lyne/introduksies (18)	8639	96.3	1.76
Lyne geselekteer vir 2013 proef (9)	8972	96.6	1.77
Vordering: eksperimenteel/kontr (%)	-6.9	1.6	5.8
Vordering: nuwe lyne/kontrole (%)	-6.5	1.9	3.2
Vordering: gesel lyne/kontrole (%)	-2.9	2.2	3.6

SABBI BARLEY REPORT 2012

A short report on the SOUTH AFRICAN BARLEY BREEDING INSTITUTE (Sabbi) Research and Development program for barley for the year 2012.

The overall goal of the program is to develop new malting barley varieties which are superior to the dominant varieties according to agronomic characteristics, malting and brewing quality and disease resistance.

To evaluate performance and progress we should look at the following:

- exploitation of germ plasm,
- genetic improvement in early generations,
- performance of lines during evaluation, and
- performance of new varieties in commercial testing phase.

1. HISTORY AND SUCCESSES

This program started in 1978 when Sensako began evaluating the available local commercial varieties in the Southern Cape. During 1979 the evaluation was extended to include the comparison of two Australian varieties with local varieties. The goal of the program was to evaluate as many varieties as possible from abroad in order to find a variety or varieties, which could be successfully cultivated in South Africa. At that time Clipper, an Australian variety, was the dominant variety in the Southern Cape.

Results of the introduction program indicated that the majority of varieties from abroad are not suitable to the growing conditions of the Southern Cape. The Australian varieties are better adapted to these conditions and two of them have been released as a result of the trials. The two varieties are Stirling (released in 1987) and Schooner (released in a restricted production area in 1989). Both of them have already been withdrawn from commercial production.

Because of the lack of success with the introduction program, a breeding program was started on a limited scale in 1983 and the program gradually developed to its present format. Introductions are still being tested, and a number of varieties and advanced lines from all the major production countries have been evaluated in this program. Introductions with the best quality, disease and agronomic characteristics are selected to be used as

germ plasm donors in crosses with local improved genotypes to generate recombinations with superior genetic ability.

During 2000 the program became part of an international enterprise when Sensako was taken over by Monsanto. Unfortunately they terminated all their barley activities at the end of 2001 and the program was taken over by SAB. At the moment the program is continued under the name of the South African Barley Breeding Institute (Sabbi), an article 21 company.

When the program started Clipper was the only variety cultivated, and cultivated very successfully, in the Southern Cape. Eight varieties have since been released from our breeding program – S5 being the latest at the beginning of 2010 (see **Table 1**). Four varieties, SSG 525 (2003), SSG 532 (2004), SSG 506 (2008) and S02-11 (2009), has already been phased out for various reasons. Five varieties of SABBI will be cultivated commercially during 2013 - SSG 564, SabbiErica, SabbiNemesia, S5 and Disa (S6). Two experimental varieties (S9 and S12) will be evaluated this year.

Last year SabbiErica continued to dominate the acreage planted, with 52,2% of the total acreage. SSG 564 decreased to only 9,0%, while SabbiNemesia and S5 were fairly stable with 30,8% and 4,6% respectively. The experimental variety S6 increased to 2,8% of the total acreage.

All our varieties are currently classified as Medium FAN Malt (MFM) varieties, although Sabbi Nemesia and S5 were used as substitute HFM malt. S6 was in its fifth year and S9 in its second year of evaluation.

A second production area was developed in the irrigation areas of the Northern Cape after intensive evaluation on variety adaptability and production practices by SABM. Production started on a small scale in 1994 when Blenheim, a variety from the United Kingdom, was introduced.

Varieties from, especially, Europe are fairly well adapted to this environment and our involvement in this area originally focused on the evaluation of introductions. In 2003 we started making crosses specifically for this area and since then the program expanded gradually to a total program although not yet on the same scale as the one for the Southern Cape.

Table 1: List of varieties released from SABBI's program in the Southern Cape and their history.

Variety	Year of exp release	Year of final release	History (as in 2012)
SSG 522	1992	-	Withdrawn before final release
SSG 525	1992	1996	Phased out in 2003
SSG 532	1993	1998	Phased out in 2004
SSG 564	1996	2005	In production (9,0%)
SSG 575	1997	-	Withdrawn before final release
SSG 585	1998	-	Withdrawn before final release
SSG 506	2000	2006	Phased out in 2008
S02-11	2002	2006	Phased out in 2009
S03-09	2003	-	Withdrawn before final release
SabbiErica (S04-11)	2004	2009	In production (52,2%)
SabbiNemesia (S04-16)	2004	2009	In production (30,8%)
S5	2005	2010	In production (4,6%)
Disa (S6)	2006	2013	Exp Year 6 (2.8%)
S7	2007	-	Withdrawn before final release
S9	2009		Experimental Year 2
S12	2012		

The first variety from our program accepted for the irrigation area was SSG 585 in 2006. Evaluation of varieties from Europe is still an integral part of the program in this area and Cocktail, an introduction from the United Kingdom, has been approved for commercial production. In 2012 Cocktail had 52,3% of the acreage. Marthe was in its third year of experimental evaluation with 5,3% of the acreage, while the commercial evaluation of Cristalia started.

Table 2: Varieties released under irrigation in the Northern Cape

Variety	Year experimental release	Year of final release	History (as in 2012)
Blenheim		1997	Phased out in 1999
Chariot	1997	2001	Phased out in 2004
Puma	2000	2003	In production (41,8%)
SSG 585	2002	2006	Phased out in 2012
Cocktail	2007	2009	In production (52,3%)
Marthe	2009		Experim Year 3 (5,3%)
Cristalia	2011		Experimental Year 1

2. RECOMBINATION PHASE

Each year a thorough evaluation of the material in the program is done and the shortcomings identified. Parental material to be used in the recombination program is then identified with these shortcomings and the demand from the industry in mind. New combinations for 2012 were planned with the following as our major priorities:

Agricultural:

Southern Cape: yield and wide adaptability is always important. High plumpness was again an important characteristic and we are also looking at drought resistance.

Irrigation: Yield and resistance to lodging are the most important characteristics for this area.

Disease resistance:

Southern Cape: An important focus point in 2012 was scald resistance and 40 out of the 46 entries in the Elite 3 trial for 2013 has resistance against this disease. Net and spot form of net blotch also remains a big problem and we also focused on these diseases.

Quality:

For both areas we are concentrating at the moment on developing a variety with the so-called HFM quality, eg. high AAL, FAN and DP values and low viscosity. Most of our quality crosses were focused in this direction, although crosses with MFM parents were also made.

Total **crosses made** in 2012 were:

Southern Cape: **86** new combinations. Of these were

26 Adapted x HFM varieties

60 Adapted x MFM varieties

67 of these crosses were where at least one of the parent has disease resistance against one or more of the important fungal diseases

Irrigation: 40 new combinations. Of these were

12 Adapted x HFM varieties

28 Adapted x MFM varieties

3. SOUTHERN CAPE DRYLAND

3.1 SELECTION PHASE

The symmetry of the lines under selection describes the progressing of recombinants advancing through the filial generations to homozygosity. This information is given in **Table 3**.

TABLE 3: Symmetry of lines progressing through the filial (F) generations to near homozygosity in the F5 generation

GENERATION	FAMILIES	LINES
F1	126	
F2	56	828
F3	36	4056
F4	35	2248
F5	55	2512
TOTAL	308	9644

Each family represents a different combination crossed earlier in the program, while a line is a five meter row within each family, the progeny of a single plant selected in the previous year in an earlier generation.

From the F2 generation 2430, the F3 generation 871 and the F4 generation 425 individual plants were selected for further evaluation in 2013. In the F5 block 429 lines were selected to be promoted to the Elite 1 trial of 2013. Material was evaluated according to the goal for each specific cross. Very strong selection was done for disease resistance in all the generations, hence the reason for the smaller population size of all the generations in comparison to previous years.

3.2 EVALUATION PHASE

Trials were run at different sites in the barley producing area of the Southern Cape, the majority being planted at the research farm on Dunghye Park near Caledon and at Napier. The number of lines that were tested at the different localities are summarised in **Table 4**.

TABLE 4: Symmetry of lines in the Evaluation Phase in the Southern Cape

PHASE	NR OF LINES	LOCALITIES
Elite 1	1025	1
Elite 2	168	2
Elite 3	46	2
LE Year 1	13	12
LE Year 2	3	12
LE Year 3	2	12
Introduction	11	1
Feed barley	6	1
Experimental 5	S6	
Experimental 2	S9	

Lines in the Elite 1 trials were evaluated on maturity, resistance to lodging, yield potential, plumpness and overall disease resistance. One hundred and sixty-eight (168) lines from these trials were selected to be advanced to the Elite 2 phase where more localities in the production area will be sampled. A limited micro malting evaluation, where we look at only a few selected characteristics, will be done on these selected lines.

Performance of the lines in the Elite 2 trials is summarised in **Table 5**

TABLE 5: Summary of the Performance of Elite 2 Lines

CULTIVAR	YIELD	PLUMPNESS (>2,5mm)	TN
Erica (Control)	7253	92.9	1.84
All lines (168)	7229	94.5	1.81
Selected lines (46)	7576	95.2	1.79
Progress with selection	4.5%	2.5%	-2.7%

Lines selected from the Elite 2 proceeds to the Elite 3 trials (numbers and localities in **Table 4**). Selection was done based on the agronomic performance of lines in 2012 and quality results from 2011.

The Elite 3 trials are the final stage before lines are promoted to the LE phase. Five lines were selected to be promoted to the LE trial of 2013. Selection was done on agronomic performance over three years and quality performance over two years of evaluation. Performances of these lines are summarised in **Table 6**.

TABLE 6: Summary of Performance of Elite 3 Lines

LINES	YIELD	PLUMPNESS >2,5mm	TN
Erica (Control)	6652	91.9	1.83
All lines (46)	6634	93.2	1.81
Selected lines (5)	7008	92.7	1.75
Progress with selection	5.4%	0.9%	-4.4%

The Introduction Trial, planted at Caledon, was made up of 11 lines from Australia and Cimmyt.

Lines from our program, the ARC's program and commercial varieties were compared in the LE trial. The LE trial of 2012 comprised of 25 entries, with SabbieErica as standard, three other varieties and 21 lines (including the experimental varieties). All of them were from our program: 3 experimental varieties, 2 third year lines, 3 second year lines and 13 first year lines.

Performances of the standard variety and the selected entries from the 2012 trial are given in **Table 7**.

TABLE 7: Performance comparison of lines from SABBI and Commercial varieties in the LE Trial in the Southern Cape in 2012

CULTIVAR	YIELD	PLUMP	KERNEL TN	4ml(72h)	8ml(72h)
SSG 564	5648	91.9	1.91	96	32
SabbiErica (std)	6425	88.9	1.91	93	37
SabbiNemesia	6041	91.1	1.90	87	33
S5	5803	93.3	1.89	89	29
S6	5884	93.2	1.86	53	15
S9	6421	88.5	1.85	93	42
S12	6701	93.7	1.91	93	25
Line 8	6841	96.2	1.85	94	22
Line 9	6457	93.3	1.91	95	39
Line 11	6331	92.0	1.85	91	24
Line 14	6626	91.4	1.86	94	36
Line 15	6739	94.3	1.90	91	28
Line 18	6388	94.1	1.91	94	34
Line 19	6339	95.9	1.93	94	36
Line 20	6607	90.4	1.92	93	26
Line 23	6704	89.3	1.81	95	27

The long-term quality performance of these lines is given in **Table 8**.

TABLE 8: Long term quality performance of lines from SABBI as percentage deviation from SabbiErica (SabbiErica=100)

CULTIVAR	EXTRACT	KI	DP	FAN	Viscosity	AAL	BETA GLUCAN
SSG 564	98.3	98.2	116.3	97.4	99.9	100.5	117.6
SabbiNemesia	99.1	100.4	117.4	105.9	99.8	102.0	94.7
S5	99.3	103.0	115.0	108.0	98.3	102.6	72.8
S6	98.8	85.4	112.3	71.2	101.7	99.2	127.6
S9	100.6	97.5	128.0	98.8	98.0	99.3	71.5
S12	100.8	106.3	133.2	111.6	97.9	102.4	121.1
Line 8	100.3	109.9	124.5	113.4	99.3	102.0	91.4
Line 9	100.0	102.2	141.7	104.0	98.9	101.8	129.9
Line 11	100.8	113.7	120.9	118.1	94.7	103.5	20.7
Line 14	100.1	90.3	109.0	90.0	100.0	100.0	239.1
Line 15	101.2	83.3	117.8	108.9	120.6	100.3	493.5
Line 18	101.3	100.0	100.9	95.4	101.9	98.1	446.7
Line 19	100.4	94.4	111.2	92.3	106.7	99.1	428.5
Line 20	100.3	112.7	97.5	109.4	106.0	102.2	82.3
Line 23	102.8	115.5	134.4	106.5	100.0	104.4	55.9

- for characteristics like extract, DP, FAN and AAL we are looking for values higher than Erica,
- for characteristics like KI, viscosity and beta glucan we are looking for values lower than Erica.

3.3. DOUBLED HAPLOID PROGRAM

The production of doubled haploid lines have escalated this year. The table below shows the progress that has been made within one year. The production of Doubled haploid plants was increased from 159 in 2011 to 929 in 2012.

	2011	2012	YoY
Ears on Induction medium	2 595	3 259	26%
Calli on Regeneration medium	12 979	70 964	447%
Green plants planted in greenhouse	436	2 095	380%
Doubled Haploids harvested	159	929	484%

We hope to increase the numbers gradually to reach our goal of at least 2000 doubled haploids per year of which most will go through the marker assisted selection program.

The number of doubled haploid lines included in the evaluation phase of the barley program in 2012 is given in **Table 9**.

TABLE 9: Status of Doubled Haploid lines in the Trials

PHASE	NR OF COMBINATIONS	NR OF LINES
Elite 1 (Southern Cape)	6	134
Elite 1 (Irrigation)	3	40
Elite 2	2	2
Elite 3	0	0
LE Southern Cape	0	0
LE Irrigation	0	0

With the use of the doubled haploid technique it is possible to shorten the selection phase with four to five years. The cumulative effect of this in the release of varieties can be enormous over a long period of time.

The cumulative effect of this over years can be enormous. Of the last eight experimental varieties that has been released, five were doubled haploids. Varieties like SabbiErica, SabbiNemesia and S5 are all doubled haploids. They were experimentally released 9, 8 and 7 years respectively after the crosses were made. This means a gain of 3, 4 and 5 years respectively over the traditional program.

Not only are they already making a big impact in local industry, they also entered the recombination program much earlier and doubled haploids were already produced from their offspring. Some of these were in the Elite 2 phase of evaluation. These doubled haploids are from crosses between the varieties and lines with good quality and disease resistance. The cumulative progress in a breeding program over a 20 year period can, indeed, be invaluable.

3.4. COMMERCIAL EVALUATION AND PHASING IN OF VARIETIES

Two experimental varieties were in commercial evaluation in 2012.

Hectares planted in 2012 were as follow:

S6	Overberg Agri	2134 ha;
S9	Overberg Agri	284 ha;
	SSK	166 ha.

Seed of S12 were multiplied under irrigation.

4. NORTHERN CAPE IRRIGATION

4.1 SELECTION PHASE

Lines from the F2, F3, F4 and F5 generations were planted at Hartswater last year. Information on these lines is given in **Table 10**.

TABLE 10: Symmetry of lines in the Selection phase under irrigation

GENERATION	FAMILIES	LINES
F2	42	820
F3	1	100
F4	10	500
F5	56	2148
DH	7	73
TOTAL	116	3641

Much emphasis was put on identifying good resistance to lodging with high yielding potential in the filial generations.

4.2 EVALUATION PHASE

The Northern Cape program is steadily changing into a local program with more of our own developed lines being tested, and less introductions. Last year we again had an Elite 1, Elite 2 and Elite 3 trial with locally developed lines. The best entries from the Elite 3 trial have been promoted to the LE trial at six localities in the Northern Cape.

The trials were run at different localities in the barley producing area of the Northern Cape. The number of lines that were tested at the different localities are summarised in **Table 11**.

TABLE 11: Symmetry of the Irrigation Evaluation Phase

PHASE	NR OF LINES	LOCALITIES
Elite 1	375	1
Elite 2	48	2
Elite 3	15	2
Introduction	13	2
LE Year 1	8	6
LE Year 2	6	6
LE Year 3	4	6
Experimental Year 3	Marthe	
Experimental Year 1	Cristalia	

Lines in the Elite 1 trial were evaluated on maturity, resistance to lodging, yield potential and plumpness. Forty-eight lines from this trial were selected to be advanced to the Elite 2 phase where more localities in the production area will be sampled. A limited micro malting evaluation, where we look at only a few selected characteristics, will be done on these selected lines.

Performance of the lines in the Elite 2 trials is summarised in **Table 12**.

TABLE 12: Summary of the performance of Elite 2 lines under irrigation

CULTIVAR	YIELD	PLUMP (>2,5mm)	TN
Cocktail (Control)	11051	95.1	1.82
All lines (48)	10088	95.6	1.94
Selected lines (15)	10679	95.9	1.92
Progress with selection	-3.4%	0.8%	5.5%

Lines selected from the Elite 2 proceeded to the Elite 3 trials of 2013.

Performance of the lines in the Elite 3 trials is summarised in **Table 13**.

TABLE 13: Summary of the performance of Elite 3 lines under irrigation

CULTIVAR	YIELD	PLUMP (>2,5mm)	TN
Cocktail (Control)	10538	95.9	1.86
All lines (15)	9518	96.0	1.91
Selected lines (3)	10011	94.2	1.86
Progress with selection	-5.0%	-1.8%	0.0%

Three of our lines and nine introductions were selected from the Elite 3 and Introduction trials to proceed to the LE trial of 2013. Selection was done based on the long term agronomic and malting performance of lines.

The LE trial of 2012 included Cocktail, Marthe, Cristalia, 10 introductions, 8 lines from our program and 3 from the ARC's program. The LE trial was planted at six localities and the results are as follows:

TABLE 14: Performance comparison of Cocktail with selected lines from the LE Irrigation Trial of 2012

CULTIVAR	YIELD	PLUMPNESS	KERNEL TN	GE (4ml72h)	GE (8ml72h)
Puma	8378	95.3	1.86	96	79
Cocktail (std)	9242	94.5	1.71	96	84
Marthe	8547	96.5	1.82	94	74
Cristalia	8654	95.4	1.79	96	75
Line 6	8930	96.6	1.79	95	78
Line 7	8520	96.9	1.93	92	67
Line 8	8408	94.9	1.76	94	83
Line 9	8630	97.2	1.73	95	83
Line 10	9235	97.6	1.76	94	85
Line 21	9302	97.5	1.81	96	86
Line 22	9489	97.2	1.70	96	82
Line 23	9028	96.7	1.70	95	76
Line 25	9207	94.7	1.73	96	79
Trial Mean	8650	96.2	1.77	95	79
CV	8.0	1.7	4.0	5.9	14.1

Marthe was in its third year and Cristalia in its first year of experimental evaluation for the irrigation area.

TABLE 15: Long term quality performance of the varieties, third and second year lines as percentage deviation from Cocktail (Cocktail=100)

CULTIVAR	EXTRACT	KI	DP	FAN	VISCOSITY	AAL	BETA GLUCAN
Marthe	100.0	100.8	142.7	104.3	98.1	103.3	69.7
Cristalia	99.7	98.7	123.1	97.1	100.4	101.7	127.4
Line 6	99.9	98.1	100.5	102.7	100.8	102.4	117.7
Line 7	100.2	96.3	108.5	93.5	101.3	101.8	104.0
Line 8	100.4	102.3	108.3	110.3	102.7	102.4	94.3
Line 9	100.5	104.6	146.9	110.0	99.3	103.4	86.2
Line 10	99.3	94.9	113.6	93.0	100.3	103.6	91.1

5. INTRODUCTIONS

We are constantly trying to introduce new varieties and lines (introductions) for evaluation and use in the breeding program. Contact was made with quite a few barley programs over the last few years and agreements have been made on the exchange of germ plasm. The following new introductions were evaluated in the program last year:

Introductions under Irrigation: 14 lines from the United Kingdom were evaluated in the Introduction Trial. Nine of these introductions were promoted to the LE trial of 2013.

Introductions Southern Cape: 5 lines from Australia were evaluated in an Introduction Trial with two from CIMMYT. All these material were thoroughly evaluated for agronomic and disease resistance characteristics and some of them promoted to this year's trials.

6. MARKER ASSISTED SELECTION

The MAS program is focusing exclusively on identifying lines with specific quality alleles originating from varieties like Harrington and Alexis. These alleles have been identified to be associated with malt extract, diastatic power, α -amylase, free α -amino nitrogen and β -

glucan (Alexis) and with β -amylase thermo stability, α -amylase and superior malt quality (Harrington).

During last year 265 lines have been screened for specific quality alleles. The pedigrees included S12/Metcalfe, S12/Newdale, Nemesia/S02-11//Copeland, S12/Harrington and S9/Harrington.

Funds were obtained from the WCT to introduce disease resistance into South African barley varieties, whilst retaining malting quality (MQ) traits. Disease resistance against five different diseases (net form of net blotch (NFNB), spot form of net blotch (SFNB), scald, SB (spot blotch) and stem rust (SR) will be introduced into current barley varieties. As most of the resistant sources do not meet the strict malting quality standards, progeny will be backcrossed to the good malting quality parent and selfed to retain these traits. DNA markers will be used to select lines that have the resistance loci. We are thus proposing to use a comprehensive disease management strategy with a special focus on retaining malting quality traits. This is a five year project proposal introducing disease resistance into South African barley varieties, whilst retaining the malting quality traits. This project is a continuing collaborative project between South Africa and Australia and will supplement the existing collaboration between barley breeders of South Africa and Australia. The outcomes of this research will be published and therefore available to other researchers.

7. FOCUS AREAS IN PROGRAM

Our focus in the program over the next few years will be mainly on three important aspects.

7.1 EXPANSION UNDER IRRIGATION

The planned expansion in the malting capacity of SAB Maltings in Johannesburg was very good news for the barley industry. This means that the barley production under irrigation will have to increase, with implications for our program in that area.

The plan is to increase our irrigation program to more or less the same status in terms of numbers as we have in the Southern Cape.

7.2 HIGH FERMENTABLE VARIETY FOR BOTH AREAS

The expansion in malting capacity again put a lot of emphasis on the development of HFM varieties for both the dry land and the irrigation areas. We are constantly searching for

sources of HFM quality to include in our crossing block to maximise the number of crosses for this trait. Marker assisted selection is also used as a tool to evaluate lines. Last year 265 lines were screened with markers for specific characteristics involved in this trait. New developed markers are also evaluated to be used in our program.

7.3 DISEASE RESISTANCE IN THE SOUTHERN CAPE

A major step was taken last year to improve the disease resistance profile in our material.

The following can be highlighted:

- 67 out of the 86 (78%) crosses made for the dry land area had at least one parent with good resistance to one or more of the fungal diseases. Emphasis is put especially on resistance against scald and the net blotches;
- The numbers in all the filial generations are much lower than in the past, because selection were very strict for disease resistance and very few lines without resistance to at least one of the fungal diseases were selected;
- 40 of the 46 lines in the Elite 3 trials have total resistance against scald, with moderate resistance present in the other 6 lines;
- The collaborative project with pathologists in Australia, Canada and the USA to identify Net blotch resistance genes proceeded in 2012;
- The collaborative project with CENGEN and the University of South Queensland to map novel leaf blotch genes continued.
- 17 of our first Erica doubled haploid lines from crosses with disease resistance material were selected from the Elite 1 last year and included in the Elite 2 phase of evaluation in 2013;
- As part of an integrated control plan, our Fungicide x Variety interactions trials has continued with Syngenta and BASF as our research partners.