



PIONEER[®]

2020 BROCHURE





THE LONG LOOK

The Pioneer way of doing business

We are an international company with a unique combination of cultures, languages and experiences. Our technologies and business environment have changed dramatically since Henry A. Wallace first founded the Hi-Bred Corn Company in 1926.

This Long Look business philosophy – our attitude toward research, production and marketing, and the worldwide network of Pioneer employees – will always remain true to the four simple statements which have guided us since our early years:

We strive to produce the best products in the market.

We deal honestly and fairly with our employees, sales representatives, business associates, customers and stockholders.

We aggressively market our products without misrepresentation.

We provide helpful management information to assist customers in making optimum profits from our products.



PIONEER®

PIONEER
IT'S MORE THAN
WHAT YOU

SEED



Fill your planter with the best thinking in modern farming

Pioneer invests in research and development to become even more effective at bringing targeted agronomic and defensive traits to your fields. The latest products and management tools, services and Pioneer® agronomy trials can help your operation reach a new level of performance.

Pioneer® Agronomy

Pioneer® agronomy trials make one thing easier - deciding.

These trials are just down the road from you, providing local on-farm crop management insights.

These trials evaluate the interaction of Genetics, Environment and Management to:

- Match the right product to the right hectare
- Improve production practices
- Minimise risk and help maximise yield



RESEARCH & DEVELOPMENT

to help develop the full potential of your hectare



WORLD-CLASS GENETICS

for the right production, the right hectare



INTERNATIONAL EXPERTISE

from a team of local professionals



PIONEER® AGRONOMY TRIALS

help hone management practices



PIONEER PREMIUM SEED TREATMENT OFFERING

is the shield for better yield



AGRONOMY

SUCCESSFUL CROP MANAGEMENT

Successful crop management needs the effective and innovative use of available agronomy references and information – especially because we are experiencing challenging times. The availability of advisors and research-based information forms the base for fundamental decision-making.

At Pioneer, we are committed to bettering crop management. Our mission is to help maximise grain production by providing useful information that is based on intensive and innovative research.

THE PIONEER AGRONOMY TEAM

The crop scientist team specialises in producing and improving food crops by developing certain experiments and methods. They have to think critically to solve problems and they plan certain studies to help improve the yield of crops. The goal is to work scientifically to produce the best crop on the most consequent base possible for any situation. It is a diverse team and each agronomist specialises in a specific crop or in a specific aspect of crop production.

The innovative research and data analysing methods that the team uses are based on farm-size research, and allows us to manage other variable factors that have an impact on crop management. The latest research and unique digital programmes are used to better grain production and to add value for the farmer with Pioneer genetics.

The Pioneer agronomy team broadens their scope of research and accelerates innovative information to supply the farmer with value-adding data in order to make informed choices throughout the year. The next step is to maximise precision farming by creating different management zones to be able to provide better information. The management zones help us to understand how the genetics react on the environment, and by stacking the data, it can lead to accurate hybrid recommendations. The right product for the right hectare can then be recommended. By using this digital technology, the Pioneer agronomy team can make better hybrid recommendations and thereby ensure that the farmer understands his land. He can then make informed decisions to maximise yields and effectiveness and to reduce risks. By doing that, we strive to ensure food security with Pioneer genetics.



PIONEER MAKES AGRICULTURE IN SOUTH AFRICA BETTER

"We will become the grower's ultimate resource, with customized solutions that help maximise their profits."



PRODUCTIVITY

Live the brand

Performance predictability

Demand planning

INTERNAL PROCESSES

Know the strategy

Know the business

Hands-on knowledge

KNOWLEDGE

HERE'S HOW

Clustered Regularly Interspaced Short Palindromic Repeats

CRISPR-Cas

WORKS for advanced plant breeding



DNA

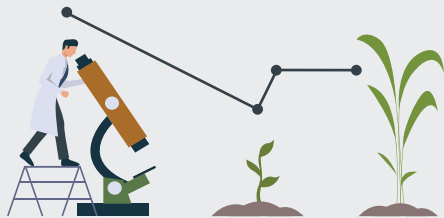
is the instruction manual for the growth and development of all living organisms

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noun **BIOCHEMISTRY**

deoxyribonucleic acid, a self-replicating material present in all living organisms as the main constituent of chromosomes. It is the carrier of genetic information.

DNA breaks & repairs happen in nature



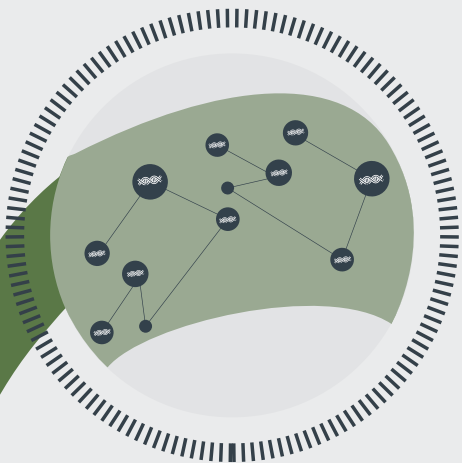
SCIENTISTS HAVE DEVELOPED A DEEP UNDERSTANDING OF THE

**genetic & physical
attributes** WITHIN PLANTS

CRISPR-Cas DIRECTS DNA BREAKS & REPAIRS TO
create specific outcomes

CRISPR-Cas reads the DNA of a plant

BASED ON HOW CRISPR-Cas IS PROGRAMMED, IT FINDS A SPECIFIC LOCATION IN THE GENOME AND EITHER



Deletes



Edits



Replaces

TARGETED GENETIC SEQUENCES

Grower & consumer **BENEFITS**



Better nutrition



Longer shelf life



Disease resistance

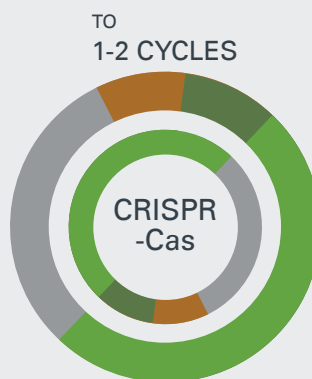
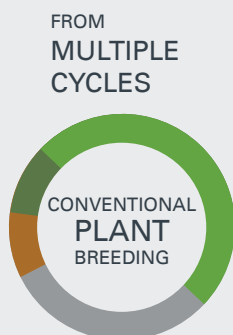


Drought tolerance



Higher yield potential

More efficient development of **healthy seed products**



PRO BOX[®]

Seed Handling System

TAKE NOTE

For the productive use of the delivery system, you will use about 1 500 ha corn or 800 ha soya per PROBOX[®] seed handling system trailer. Why?

- This means 2 x 12 or 16 rows of planters per trailer
- Seed volumes required are 20-25 boxes of maize per 1 500 ha or 60 boxes of soybeans per 800 ha
- Thus you fill the planter boxes only once a day for maize, and five times for soybeans
- Remember, you can load different cultivars on the wagon

UNIQUE TO PIONEER

- In SA, the trailer is exclusively manufactured for Pioneer to ensure that parts and services are quickly accessible
- The trailer is designed to transport four PROBOX seed handling system which is equivalent to four tons of seed
- The trailer can transport maize and soya seed





BENEFITS OF THE PROBOX SEED HANDLING SYSTEM

- It takes only eight minutes to fill the planter boxes with seed and fertiliser, and both tasks are completed simultaneously
- Up to six planter boxes can be filled without moving the trailer
- Speed and handling of the trailer is really good
- Moves faster by road than usual trailers
- High quality for high-value product
- Waterproof – from top to bottom
- Can be used for soya and corn seeds
- Protection against rats and mice
- Safe and easy storage
- Easy handling
- Reusable



PROBULK™ SYSTEM FACILITY

UNIQUE TO PIONEER

- The facility is situated in Hendrina, Mpumalanga – centrally located in the main soy grower area of SA
- The aim is specifically to apply seed treatment quicker to soybeans
- With this, quicker and better spreading of Pioneer genetics and quality is assured



BENEFITS OF PROBULK SYSTEM

- End product is of outstanding quality
- Quick supply of treated seed
- Boxes are supplied directly on the farm
- Convenient access to Pioneer genetics and technology
- Seed distribution is by means of PROBOX® seed handling system
- Boxes can be reused



PIONEER PREMIUM SEED TREATMENT

PROTECT YOUR SEED INVESTMENT BY PROVIDING AN EXTRA LEVEL OF DEFENCE AGAINST EARLY-SEASON INSECTS AND DISEASES.


Pioneer Premium Seed Treatment offering lets you plant early and get your crops off to a strong start by delivering:

- Better emergence and stronger, more uniform stands
- Protection for tender seedlings in cooler weather
- A growing advantage in less-than-ideal environments

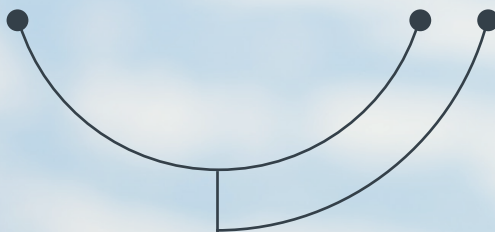




OUR PURPOSE



To enrich the lives of those who produce and those who consume, ensuring progress for generations to come.



OUR VALUES



ENRICH LIVES

We commit to enhancing lives and the land



STAND TALL

We are leaders and act boldly



BE CURIOUS

We innovate relentlessly



BUILD TOGETHER

We grow by working together



BE UPSTANDING

We always do what's right



LIVE SAFELY

We embrace safety and the environment in all we do

BIOTECHNOLOGY GUIDE 2020

PIONEER® BRAND PRODUCTS

STEWARDSHIP OVERVIEW

A MESSAGE ABOUT STEWARDSHIP

When Pioneer introduces a new product, we are in it for the long haul. Our philosophy of product stewardship means responsible management of the life cycle of our technologies, every step of the way – from initial research to the discontinuation of a product – for maximum product value, benefits and longevity. This is why Pioneer requires all growers to comply with regulations, Pioneer policies and crop management strategies specific to the product. In the Pioneer Technology Use Agreement (TUA) and Terms and Conditions of Purchase, growers who plant Pioneer® brand seed with biotech traits agree to adhere to the stewardship requirements described in this guide.

This includes, without limitation, the following:

- Following directions of use on all seeds, and labels for pesticides
- Implementing Insect Resistance Management (IRM) practices, before and after planting, for specific biotech traits as required by Pioneer and SA authorities
- For crops or material containing biotech traits, confirming trait acceptance and intended uses and destinations with grain handlers prior to delivery or using those products on-farm
- No exportation of seeds or any other material containing biotech traits into countries where the product is not allowed or registered, including through a third party
- Following any additional stewardship requirements that Pioneer deems necessary for a particular product (e.g. grain or feed use restrictions and geographical planting restrictions)

Growers are responsible for following the applicable stewardship guidelines and weed resistance management guidelines as set out in this guide.



WHY IS STEWARDSHIP IMPORTANT?

Proper stewardship of products is important because it offers the following benefits to growers:

- Signing the TUA permits access to Pioneer germplasm and biotech trait technologies in its seed products
- Following IRM requirements delays the development of insect resistance to incorporated plant protection technologies and help to maintain the long-term durability of these technologies
- Using seed products solely for producing a single commercial crop encourages the development of better, high yield potential germplasm and additional technologies and innovations, further improving agricultural productivity

OUR COMMITMENT TO EXCELLENCE THROUGH STEWARDSHIP®

Pioneer is a member of Excellence Through Stewardship® (ETS). Pioneer products are commercialized in accordance with ETS Product Launch Stewardship Guidance and in compliance with the Pioneer policies regarding stewardship of those products. Crops and materials containing biotech traits may only be exported to or used, processed or sold in jurisdictions where all necessary regulatory approvals have been granted for those particular crops and materials. It is a violation of national and international laws to move materials containing biotech traits across borders into jurisdictions where their import is not permitted. Growers should discuss these issues with their purchaser or grain handler to confirm the purchaser or handler's position on products being purchased. Excellence Through Stewardship® is a registered trademark of the Excellence Through Stewardship.

PIONEER TECHNOLOGY USE AGREEMENT (TUA)

It is of the utmost importance and required by law for the supplier and purchaser who intend to use the technology to enter into a lawful agreement by signing a TUA.

The Pioneer TUA allows farmers to purchase and plant Pioneer® brand products containing certain technology traits. Such an agreement should be signed every season and be handed over to the Pioneer sales professional immediately before seed can be issued.

The TUA also stipulates that:

- Any grower who has not signed a TUA must immediately notify Pioneer and make arrangements to sign the TUA or return the seed to the company
- Licensed products are to be used solely for planting a single commercial crop and shall not be exported for planting in another country by growers or supplied to any other person for planting
- Any purchase of licensed products by a grower who is not authorised or is not our licensed grower (i.e. did not sign a TUA) shall be void

GROWING CONVENTIONAL AND BIOTECH CROPS

For decades, multiple agricultural systems have coexisted successfully around the world from production through supply chains. Over time, best practices to facilitate these different agricultural systems have developed and have been improved continuously to ensure that high-purity and high-quality seed and grain are available to support trade from various agricultural systems.

One example of such coexistence is the production of similar commodities in close proximity such as field corn, sweet corn, white corn and popcorn. Coexistence strategies should meet market requirements using science-based industry standards and management practices, and should be flexible to facilitate options and choices for growers and the food and feed supply chain. This flexibility should also include the ability of coexistence strategies to be modified as changes in products, markets or practices occur.

The ongoing success of coexistence strategies depended upon co-operation, communication, flexibility and mutual respect for each cropping system and among growers using these various systems. Over the years, growers have adapted to changes and innovations in agriculture by using new farm management practices, new technologies and other appropriate practices. It is incumbent upon a grower who is growing a crop to satisfy a particular market and to implement best practices to satisfy those market standards. By seeking to satisfy that market, the grower inherently agrees to use the appropriate practices to ensure the integrity and marketability of his or her crop in the market in which he or she seeks to market it. This is true, regardless of the particular market being served, whether it is white corn, sweet corn, organically produced corn or conventionally produced corn. In each of these cases, the grower is producing a crop supported by a special market price and therefore, assumes responsibility for meeting any applicable market specifications to receive the applicable premium price from that market. Even though the responsibility rests with the grower producing the crop for a particular market, it is each grower's responsibility to communicate with, and be aware of the planting intentions of his or her neighbours to gauge the need for any appropriate best management practices.

IDENTITY PRESERVED (IP) CROPS

IP crops are crops produced to meet the needs of specialised end-use markets. These crops are grown with a specific end use in mind, such as waxy, white and organic, amongst others, and should meet the defined requirements of that market. IP crops provide benefits for both the grower, with processor-paid incentives, as well as the end user. Growers who choose to preserve the identity of their crops to receive the additional end-use market value assume the responsibility of ensuring that their crops meet the contract specifications. To meet these specifications, the specialised end-use agricultural industry has developed generally accepted IP agricultural practices to manage IP production, as further described below. Accordingly, IP growers have the responsibility to implement any processes that are necessary to meet quality specifications. The special care required for IP crop production generally causes an increase in production costs that, in turn, causes an increase in the value of the goods sold.

MAINTAINING THE INTEGRITY OF IP CROPS

In order to preserve the identity of IP crops, thorough clean-out procedures should be implemented before and after contact is made with the IP crop. This may include cleaning areas in seed storage bins, seed boxes (hoppers), transportation vehicles, combines and harvesters. Thorough clean-out procedures should be upheld throughout all aspects of the planting procedure, which include storage, transportation, planting and harvesting. Additionally, growers of IP crops should consider steps to minimise the potential for crosspollination given the generally recognised and accepted occurrence of the movement of incidental amounts of pollen. As previously stated, communication between growers is key in determining the best agricultural management practices that should be implemented to maintain the identity of IP crops.



SEED TREATMENT STEWARDSHIP

Seed treatments, including fungicides, insecticides, nematicides and amendments play a critical role in agriculture and the production of a healthy crop. In addition to managing early-season pests and diseases, they serve as a viable alternative to foliar and soil applications.

Seed treatment management and responsible stewardship play a vital role in sustaining our environment, while maximising crop health. Responsible stewardship practices help maintain seed and seed treatment integrity, which keeps the active ingredient on the seed to achieve the maximum crop health benefit for the investment. In addition, these practices help minimise the potential for adverse effects on producers and the environment, including pollinators which may be present at the time of planting.

Pioneer is committed to our values of enriching lives, standing tall, being curious, building together, being upstanding and living safely. In addition, the Pioneer Long Look philosophy states that we are committed to providing helpful management suggestions to our customers.

The following best management practice suggestions are in the spirit of our values and the Pioneer Long Look:

HANDLING

- Always read and follow the label directions and recommendations for proper handling and use of treated seed and seed treatments
- Use personal protection equipment as recommended on the product label or seed tag
- Follow all safety precautions as indicated on the label or seed tag
- Transport and transfer treated seed safely and in a manner that minimizes the risk of spillage and dust

PLANTING

- Always follow planter manufacturer recommendations and avoid excess use of talc and graphite
- Be aware of the environment in and around your field, taking note of nearby hives and flowering plants and weeds, which could be attractive to pollinators
- Limit dust movement from seed packages containing seed treatment. For example, consider factors such as wind speed and direction and avoid shaking the bottom of the treated seed bag when filling planting equipment
- Do not transfer treated seed next to active hives, at field margins, and adjacent to flowering plants and vegetation
- For pneumatic planters, direct the exhaust towards the soil surface
- Ensure all seeds are planted or incorporated into the soil at a proper planting depth
- Follow labelling requirements for disposal or use of unused seed

DISPOSAL AND CLEAN-UP

- Properly dispose of seed packaging or containers in accordance with national and local regulations and the container return policy
- Clean the planting equipment in a manner that minimises dust
- Avoid cleaning the planting equipment next to active hives, at field margins, and adjacent to flowering plants and vegetation

GUIDE FOR THE USE OF BIOTECHNOLOGY PRODUCTS

This guide contains information for proper Insect Resistance Management for Pioneer® brand maize that contains the YieldGard® stalk borer technology and YieldGard® Maize 2 technology.

Further information includes the proper management of herbicide-tolerant crops for Pioneer brand maize with the YieldGard® Maize 2 technology, stacked with Roundup Ready® Maize 2 technologies and Pioneer brand soybean varieties containing Glyphosate Tolerant technology.

IMPORTANT – READ BEFORE PLANTING

WHAT IS YIELDGARD® AND YIELDGARD® MAIZE 2 TECHNOLOGY?

YieldGard® stalk borer technology and YieldGard® Maize 2 technology allows farmers to plant Pioneer brand maize with built-in protection to control several important maize insect pests. Pioneer brand maize with the YieldGard® stalk borer technology and YieldGard® Maize 2 technology confers protection against *Busseola Fusca* (maize stalk borer) and *Chilo Partellus* (sorghum stalk borer).

Note: These insects will be referred to collectively as ‘stalk borers’ throughout the balance of this document.

EFFECTIVENESS OF PIONEER BRAND MAIZE HYBRID WITH THE YIELDGARD® STALK BORER TECHNOLOGY AND YIELDGARD® MAIZE 2 TECHNOLOGY

STALK BORER TECHNOLOGY

The *Busseola* stalk borer is not easily controlled. Please note that, in general, the population pressure of stalk borers is higher during the reproductive phase of the plant (window period – VT to R1 stage) compared with the first generation that infests the plants in an earlier growing phase. Stalk borer resistance is therefore scored lower for the window period compared to the first generation.

It is of the utmost importance to monitor stalk borer resistance throughout the season and consult with your Pioneer agronomist.

THE IMPORTANCE OF INSECT RESISTANCE MANAGEMENT (IRM)

Compliance with IRM requirements is a stewardship obligation and is critical to maintaining the longevity and effectiveness of Pioneer brand maize with YieldGard® stalk borer technology and YieldGard® Maize 2 technology. If only Pioneer brand maize with YieldGard® stalk borer technology or YieldGard® Maize 2 technology is cultivated, rare insects that may be resistant and which survive could mate with other resistant insects and thus pass on the resistance to their offspring. To delay the development of insect resistant populations to maize with YieldGard® stalk borer technology and YieldGard® Maize 2 technology, growers planting Pioneer brand maize with the technology are required to also plant a separate area of Pioneer brand maize without the technology, known as a ‘refuge’.

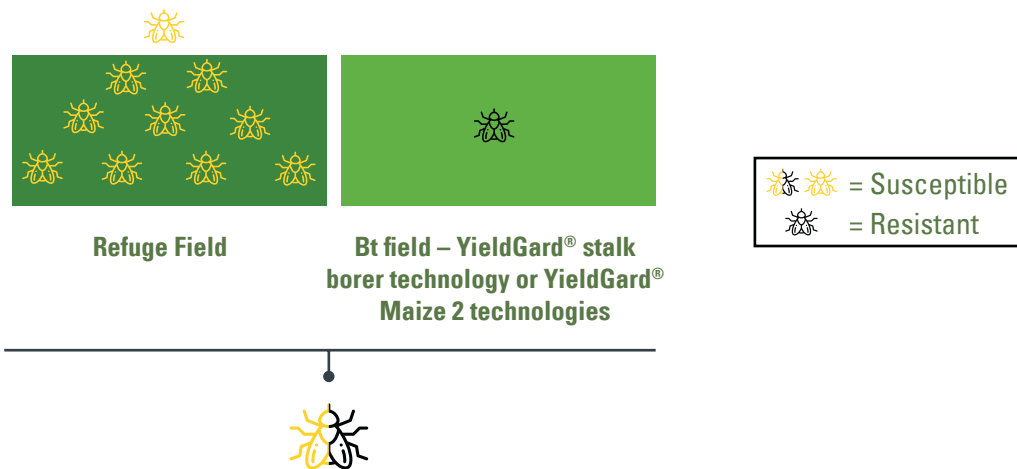


INSECT RESISTANCE MANAGEMENT (IRM)

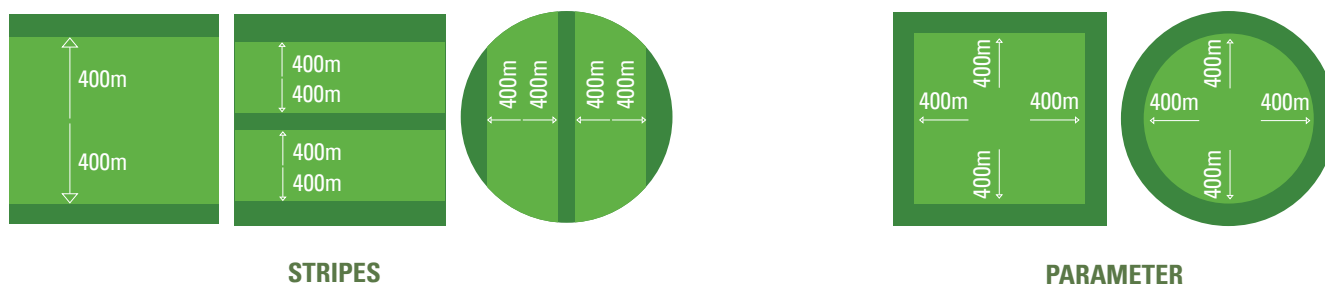
A refuge is a block or strip of maize without technology. The primary purpose of a refuge is to maintain a population of stalk borers that are susceptible to the YieldGard® stalk borer technology and YieldGard® Maize 2 technologies. Potentially resistant insects emerging from fields with the YieldGard® stalk borer technology or YieldGard® Maize 2 technology can mate with susceptible stalk borer moths from the refuge, resulting in offspring that are susceptible to YieldGard® stalk borer technology and YieldGard® Maize 2 stalk borer technologies. Please refer to the figure as illustrated further in the document.

REFUGE MANAGEMENT FOR PIONEER® BRAND MAIZE WITH YIELDGARD® STALK BORER TECHNOLOGY AND YIELDGARD® MAIZE 2 TECHNOLOGY

- Planting a refuge is a requirement for growing the technology and is a primary component of IRM. There are two acceptable refuge options:
 - 95% YieldGard® stalk borer technology and YieldGard® Maize 2 technology with an accompanying 5% refuge – with this option no chemical control for targeted insects is permitted on the refuge hectares
 - 80% YieldGard® stalk borer technology and YieldGard® Maize 2 technology with an accompanying 20% refuge – with this option, chemical control of targeted insects is permitted on refuge hectares if economic thresholds are met
- Maize refuge options include hybrids without the stalk borer trait, hybrids with Roundup Ready® Maize 2 technology, and conventional maize
- Pioneer brand maize with YieldGard® stalk borer technology and YieldGard® Maize 2 technology and refuge hybrids must be of similar maturity
- The refuge must be planted within seven days, under the same growing conditions as the hybrid with YieldGard® stalk borer technology and/or YieldGard® Maize 2 technology. For example, if the hybrid with YieldGard® stalk borer technology and/or YieldGard® Maize 2 technology is planted under irrigation, the refuge must also be under irrigation
- The refuge area must be closer than 400m from the furthest point of the field containing Pioneer brand maize with YieldGard® stalk borer technology and/or YieldGard® Maize 2 technology
- **A neighbour's field does NOT qualify as a refuge**
- Mixing of seed containing YieldGard® stalk borer technology and YieldGard® Maize 2 technology with seed without the stalk borer trait is NOT an acceptable refuge design
- Planter bins should be properly cleaned before switching from seed containing YieldGard® stalk borer technology or YieldGard® Maize 2 technology to seed without the stalk borer trait, and vice versa
- Avoid volunteer plant with YieldGard® stalk borer technology and/or YieldGard® Maize 2 technology in the refuge area
- Monitor and scout fields frequently:
 - Immediately report to the authorised Pioneer sales professional if unexpected damage is observed with YieldGard® stalk borer technology or YieldGard® Maize 2 technologies
 - Apply curative chemical applications when advised



EXAMPLES OF IN-FIELD REFUGE PLANTING OPTIONS:
 (Refuge strategies are applicable on the 80/20 and 95/5 options)



BEST PRACTICES FOR FOLLOWING INTEGRATED PEST MANAGEMENT (IPM)

The value of any biotech trait or insecticide spray programme could be enhanced if used within the context of an IPM (Integrated Pest Management) programme. Monitoring and judicious use of properly timed insecticide spray helps protect the durability of both the trait and chemistry.

Pioneer recommends implementing the following best practices to maximise the value of the Bt trait:

- Regular scouting of the crop to look for unexpected damage caused by *Busseola fusca*
- Immediately report to the authorised Pioneer sales professional if unexpected damage is observed
- Where it is practical, early burndown of weeds, tillage, planting date adjustment and crop rotation are all part of an IPM programme that could help minimise crop damage by insect pests

IPM SPRAY PROGRAMME

Pioneer has implemented an IPM programme to help farmers maximise the yield of their high yield potential Pioneer brand corn hybrids with the YieldGard® stalk borer technology.

To qualify for the benefits of the programme, customers need to:

- Sign the TUA at least once a year and return it to Pioneer
- Refuge areas must be planted in fields with insect-resistant maize according to the prescribed guidelines contained in this brochure
- NON-COMPLIANCE with any of the above requirements will disqualify the farmer from the IPM programme



Pioneer recommends implementing the following best practices to maximise the value of the Bt trait:

- Insecticide sprays are implemented at >5% damage and where no tassel formation is present
- The IPM spray programme DOES NOT apply to MON89034 (YieldGard® Maize 2 technology) maize or Chilo partellus damage for MON810 maize. If insect damage is observed on MON89034 maize plants or C. partellus on MON810 maize, a Pioneer sales professional or agronomist must be contacted to provide advice and appropriate remedial actions
- Only insecticide costs are covered and NO application costs will be incurred by the spray programme
- This programme covers one spray per season (not per target pest)

Any person who participates in the IPM insecticide spray programme must first enroll for the programme and receive procedure manuals. Please consult your Pioneer sales professional for additional information regarding specific details (protocols) of the IPM programme.

BEST PRACTICES FOR MANAGING HERBICIDE-TOLERANT CROPS

IMPORTANT – READ BEFORE PLANTING

WHAT IS HERBICIDE-TOLERANT SEED TECHNOLOGY?

Herbicide-tolerant crops can tolerate herbicides at application rates that will kill non-herbicide-tolerant Pioneer brand maize or varieties of the same crop species. Crops with traits for herbicide tolerance allow farmers to apply herbicides to their crops that they would otherwise be unable to utilise, without causing death or unacceptable injury to that crop.

IMPORTANCE OF MANAGING HERBICIDE-TOLERANT CROPS AND WEED RESISTANCE TO HERBICIDES

Properly managing herbicide-tolerant crop technology is important to preserve the effectiveness and value of the tolerant crop seed and its corresponding herbicides in the future. Growers utilising herbicide programmes that include herbicide-tolerant crops can do so on an annual basis provided the technology is managed effectively. If you have any questions after reviewing this information, please contact your authorised Pioneer sales professional or agronomist.



PIONEER®



BEST PRACTICES

- The use of herbicide-tolerant crops does not limit the grower to use only one herbicide product. Conventional herbicides can and should still be part of the grower's overall weed management system
- Limit the number of applications of a single herbicide or herbicides from the same mode of action family within a single growing season
- Apply herbicides at recommended dosages and at the recommended stage of weed growth, as stated on the label
- Use mixtures or sequential treatments of an effective alternative mode of action to control target weeds
- Use alternative weed management practices such as crop rotation, mechanical cultivation, delayed planting and weed-free crop seed
- Clean equipment before moving between fields to minimise the dispersion of weed seed
- Scout fields after herbicide application to detect weed escapes or shifts. If a potentially resistant weed or weed population has been detected, use available control methods to avoid seed dispersion in the field



MANAGING VOLUNTEER HERBICIDE TOLERANT CROPS

The seed of some crops can escape harvest, germinate the following year and become 'volunteer' weeds in a rotational crop. This can happen regardless of whether the crop seed was herbicide-tolerant or not. Many tools are available for managing herbicide-tolerant volunteers, but advanced planning is advised to ensure the greatest adaptability and success.

The best strategies for managing herbicide-tolerant volunteers are crop rotation and rotation of herbicides with different mode of action. The proper adjustment of harvesting equipment and the cultivation and tillage management will also help reduce volunteer plants from previous crops. Plan at least a year ahead when planting a herbicide-tolerant crop to make sure you have a weed management plan that will control any herbicide-tolerant volunteers, using alternative herbicide with different mode-of-action families and/or tillage for the next crop.





REPORT SUSPECTED CASES OF WEED RESISTANCE TO HERBICIDES

Possible indicators of weed resistance to herbicides include achieving good control of all but one of the labelled weed species in the field with the herbicide, and/or failure of repeated applications of the same herbicide to control only that weed species in a field. Take note that weed control failures can have many causes that are not necessarily related to herbicide resistance. Lack of rainfall to activate preemergence herbicides, rainfall right after post-emergence applications that wash the herbicide off the plant, cool temperatures, slow growth reducing herbicide activity in the plant, improper application timing, or improperly calibrated application equipment are amongst the many causes of less-than-expected herbicide performance. If you suspect a weed control failure is caused by weed resistance to a herbicide, you should first contact your herbicide retailer's or herbicide manufacturer's representative and your local Pioneer agronomist and conduct a thorough investigation that can eliminate other more common causes of poor weed control. Your local Pioneer agronomist will assist you with the additional steps that will be required if weed resistance to the herbicide is believed to be the issue.


CHARACTERISTICS & RATINGS

MAIZE, SOYBEANS AND SUNFLOWER

Yellow Maize Hybrids						Characteristic Ratings			Disease Tolerance and Insect Resistance					Silage	
	Mon89 / Mon810	Technology	VRV / CRM	Irrigation	Dry Land	Prolificacy	Productive Tillers	Standability	Common Rust	Northern Leaf Blight	Grey Leaf Spot	Stalk Borer Resistance 1st Generation	Stalkborer Resistance Reproductive Phase of Plant	Silage Dry Land	Silage Irrigation
P1513			114	No	Yes										
P1788			118	No	Yes										
P1788R		RR2	118	No	Yes										
P1788B	Mon89	VTP	118	No	Yes										
P1788BR	Mon89	VTP, RR2	118	No	Yes										
Phb 33H56			114	No	Yes										
Phb 33H58BR	Mon89	VTP, RR2	115	No	Yes										
P2137			119	No	Yes										
P2137B	Mon810	YG	119	No	Yes										
P2137BR	Mon89	VTP, RR2	119	No	Yes										
P2432			122	No	Yes										
P2432R		RR2	122	No	Yes										
P2432BR	Mon89	VTP, RR2	123	No	Yes										
P1184			111	Yes	No										
P1184BR	Mon810	YG, RR2	111	Yes	No										
P1690BR	Mon810	YG, RR2	117	Yes	Yes										
P1745R		RR2	117	Yes	No										
Phb 31D22BR	Mon810	YG, RR2	118	Yes	No										
P1197			111	Yes	No										
P1197R		RR2	111	Yes	No										
P1197YHR	Mon810/HX	YG, HX, RR2	111	Yes	No										




RR2 = Roundup Ready® Maize 2
 YG = YieldGard® Stalk Borer Technology
 YGII = YieldGard® Maize 2 (VTP)
 HX = Herculex®




Good 
 Average 
 Weak 

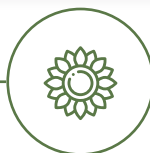
High 
 Average 
 Low 

SUNFLOWER	CHARACTERISTIC RATINGS										DISEASE RESISTANCE							
	Relative days to 50% flower (5.5)	Relative days to physiological ripeness (g)	Head: Curvature and Placement	Head: Form	Yield potential	Uniformity	Plant height (cm)	Seed oil concentration %		Protein concentration %		Oil Harvest (t/ha)		Brown rust (<i>Puccinia Helianthi</i>)	White rust (<i>Albugo Tragopogonis</i>)	Root and stem disease	Alternaria	Standability
								Oos	Wes	Oos	Wes	Oos	Wes					
P 64LL23	62-68	108-112					160	**	**	**	**	**	**		**			
P 65LL02	72	112-116					180	42,6	43,4	17,8	19,3	0,6	1,1				**	
P 65LP54*	72	111-114					175	37,7	39,9	18,6	18,9	0,6	1					
P 65LL14	68-72	111					170	39,4	43,5	18,8	18,5	0,5	1,1			**	**	

* Clearfield Plus
 ** Insufficient data

Good 
 Average 
 Weak 

High 
 Average 
 Low 



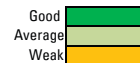


White Maize Hybrids						Characteristic Ratings			Disease Tolerance and Insect Resistance					Silage	
	Mon89 / Mon810	Technology	VRV / CRM	Irrigation	Dry Land	Prolificacy	Productive Tillers	Standability	Common Rust	Northern Leaf Blight	Grey Leaf Spot	Stalk Borer Resistance 1st Generation	Stalkborer Resistance Reproductive Phase of Plant	Stilage Dry Land	Stilage Irrigation
P2553W			123	No	Yes										
P2553WB	Mon810	YG	123	No	Yes										
P2553WR		RR2	123	No	Yes										
P2553WBR	Mon810	YG,RR2	123	No	Yes										
P2369W		RR2	121	Yes	Yes										
P2531WR				No	Yes										
P2927WR		RR2	129	No	Yes										
P2927WWR	Mon810	YG,RR2	129	No	Yes										
P2842W			128	No	Yes										
P2865WBR	Mon89	VTP,RR2	128	No	Yes										
P2565WB	Mon89	VTP,RR2	125	No	Yes										
P1517W			116	Yes	No										
P1517WR		RR2	116	Yes	No										
Phb 32B07BR	Mon810	YG,RR2	116	Yes	Yes										

RR2 = Roundup Ready® Maize 2
 YG = YieldGard® Stalk Borer Technology
 YGII = YieldGard® Maize 2 (VTP)



SOYBEANS	CHARACTERISTIC RATINGS													
	Technology	VRV	Irrigation	Dry Land	Relative days to 50% bloom	Relative days to harvest ready	Habit of growth	Shattering resistance	Pod height (cm)	Standability	Plant height (cm)	Hypocotyl length	Hilum colour	Flower colour
P48T48R	Glyphosate tolerant	4,8	Yes	Yes	42-63	111-138	Indeterminate		10		73		Black	White
P61T38R	Glyphosate tolerant	6,1	Yes	Yes	46-73	132-166	Determinate		11		85		Dark Brown	White
P64T39R	Glyphosate tolerant	6,4	Yes	Yes	50-83	130-167	Indeterminate		11		98		Colourless	White
P71T74R	Glyphosate tolerant	7,1	Yes	Yes	55-95	138-190	Indeterminate		11		101		Dark Brown	White



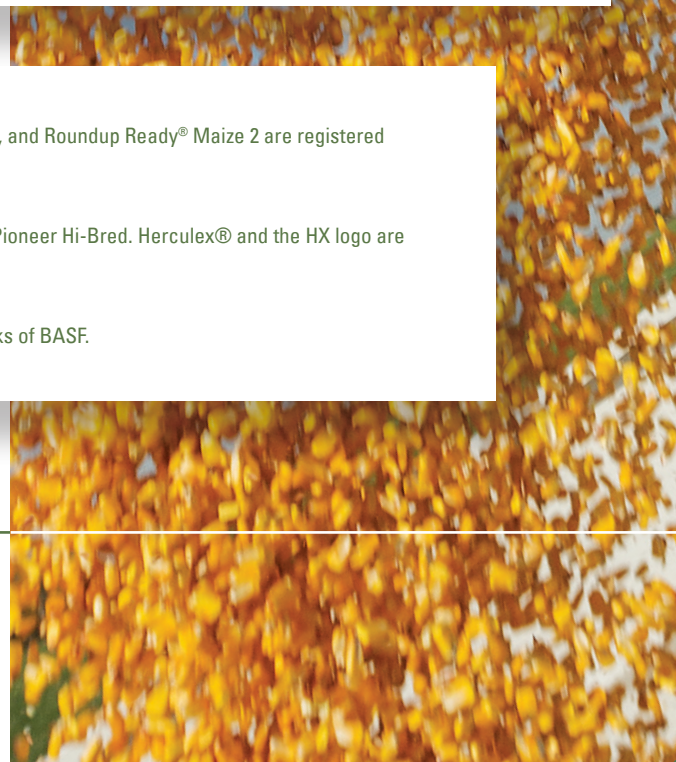
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MAIZE SILAGE

THE EVALUATION OF DIFFERENT HYBRIDS

The expectations placed on a good silage hybrid can differ greatly because of the producer's needs for use (for animal feeding it can be milk production), but the biggest need or expectation lies with the producers, food specialists and contractors that are involved in the production of silage. The opinions of quantity versus quality when it comes to silage, are discussed regularly, but a good rule of thumb is the following:

1. High yield potential per hectare
2. High starch yield per Kg DM
3. High Total Digestible Nutrients (TDN)**

Proteins are measured and given values, but in our maize silage observations it is of less importance. Proteins in maize silage are mainly influenced by cut time, the physiological phase of the maize plant.

****Total Digestible Nutrients (TDN)** of silage are measured from the digestibility of crude protein, fat and fiber (thus NDF and all fiber fractions), and non-structural carbohydrates (includes starches). A good (high) TDN value are found with low fiber, high digestibility of all fiber fractions and a high starch content.

METHODS AND ANALYTICS

A sample representing each hybrid was taken over the 2018-2019 season's trials. Sampling was conducted by following a protocol outlined by **AgSci Unlimited Silage Consultancy**. The protocol indicated the decision of cut time, by cutting and drying the maize material, by determining the dry material (DM)**, using measures and parameters during harvesting, taking of samples, ensilage and analyzing of fermented samples.

**** Dry Material (DM)** is shown as a percentage. Dry material is the content of the sample that is free of moisture. Because moisture thins out the concentration of nutrients, but it does not have a big influence on intake, it is important to always balance and evaluate the rations (allowances) on a dry material base.

LABORATORY

All analysis was done in the laboratory **Labworld (Pty) Ltd in Isando, Johannesburg**; an affiliate of CVAS (Cumberland Valley Analytical Services) in the USA. NIR technology is used to measure the nutrition parameters of fermented silage.

STATISTICS

The "One-way analysis of variance" (ANOVA) procedure was used to show meaningful differences between the nutrition parameters, through the Tukey's Studentized Range test (HSD). The nutrition parameters are:

1. Dry Material (DM)
2. Neutral Detergent Fiber (NDF)
3. NDF 30-hour digestibility
4. Starch
5. Total Digestible Nutrients (TDN)
6. Milk per ton

Meaningful differences were measured by ANOVA for the above six parameters. P-values were < 0.0001.

FERMENTATION

All plants were cut at the R5 physiological stage. All ensilaged trial samples fermented well. Therefore no comments can be made on the ability to ensilage the different hybrids that were measured. By following and correctly applying the protocol, good ensilage was obtained.

RESULTS AND FEEDBACK

NDF DIGESTIBILITY:

The NDF-fraction of crude fiber and the digestibility thereof (in this case the prediction after 30 hours in the rumen), are used as an indication of the type and usefulness of the fiber in the plant. Ruminants are masters in the use of fiber through microbial fermentation in the rumen, and it is because of this that ruminants are able to use these components so effectively, which leads to the point where we can make silage from the whole plant.

MILK PER TON:

This is a specific measurement and is based on the laboratory that was used for the analysis (CVAS). This is an indication of what can be used by dairy farmers.

Are yellow or white maize better for silage? There are mostly no differences between nutritional values, such as fiber levels or starch yields. What we need to do is to optimize the quantity and quality. If a white hybrid shows better quantity and quality than a yellow hybrid on a specific farm, it will be a good hybrid for silage.

Norms of the different parameters measured in the laboratory:

Yields are given in tons as-is @ 35% DM	Good	Average	Poor
Dry land	>40	20 - 40	<20
Irrigation	>60	30 - 60	<30
Measured objectives	Under Norm	On Norm	Above Norm
Neutral Detergent Fiber (NDF)	<37%	37 - 42%	> 43%
NDF at 30 hours digestibility	<54%	54 - 58%	>59%
Starch	<27%	27 - 39%	>39%
Crude Protein (CP)	<6.5%	6.5 - 9.2%	>9.2%
Total Digestible Nutrients (TDN)	<65%	65 - 72%	>72%

● Concern ● Acceptable ● Strength



1. Irrigation: Two hybrids planted at 70 000 stance.

IRRIGATION					
Cultivar	CRM	Days from plant to cut	%DM at Harvest	Yield at 35%DM	Plants harvested
P1184BR	111	106	38	A	66,000
P1690BR	117	106	36	A	62,000

IRRIGATION						
Cultivar	NDF	NDF at 30h digestibility	Starch	Crude Protein (CP)	TDN	Milk per ton (kg/ton as-is)
P1184BR	S	S	S	8.9	S	1542
P1690BR	S	S	S	8.0	S	1547

- There were no big differences between the two irrigation hybrids, but P1184BR just beat P1690BR on certain parameters such as fiber, protein and starch on the 70 000 stance.
- For the above reasons P1184BR are a good hybrid to use for silage under irrigation.
- One sample was taken under irrigation, on both hybrids, on a higher plant population (80 000 plants) but no recurring tests were done. Higher plant population did however show an increase in starch and indicated better TDN values.

2. Dryland: Six hybrids at 70 000 stance

DRYLAND					
Cultivar	CRM	Days from plant to cut	%DM at Harvest	Yield at 35%DM	Plants harvested
P1184BR	111	121	31	A	62,880
P1690BR	117	121	27	A	68,120
P2432R	124	136	25	A	68,120
P2553W	123	136	30	A	67,465
P2842W	128	148	27	S	66,155
P2927WYR	129	148	25	A	70,740

DRYLAND						
Cultivar	NDF	NDF at 30h digestibility	Starch	Crude Protein (CP)	TDN	Milk per ton (kg/ton as-is)
P1184BR	S	S	S	9.9	S	1659
P1690BR	S	S	S	9.7	S	1544
P2432R	S	S	A	10.6	S	1352
P2553W	S	S	A	10.0	S	1303
P2842W	S	S	S	9.7	S	1510
P2927WYR	A	A	A	10.0	S	935

- Take into consideration that some of the hybrids were cut earlier in comparison to the irrigation hybrids, and therefore the % DM is lower. A 5% to 10% higher DM will influence the parameters that were tested and at the same time better the quality of the silage.
- Between P1184BR and P1690BR, P1690BR delivered a better yield at 35% DM and is on the norm with the nutrition parameters.
- Between Pioneer® hybrid P2432R and Pioneer® hybrid P2553W, P2432R delivered better nutrition parameters.
- Between Pioneer® hybrid P2842W and Pioneer® hybrid P2927WYR, P2842W performed better, but P2927WYR could have done better if a higher % DM were received during cut time.

***Note: For more information on the agronomical qualities of each hybrid, refer back to page 28**



TERMS AND CONDITIONS:

- The beforementioned information are only for informative purposes. Contact your Pioneer sales agent for more information and recommendations regarding your specific farming practices.
- The performance of products is erratic and depends on a lot of different factors such as moisture stress, heat stress, soil type, environmental stresses as well as diseases and plagues.
- Individual results can vary.
- Recommendations in this report are made with good intentions and are based on the samples that were analyzed. No responsibility will be accepted for loss of production or otherwise, related to a possible negative aspect of any chosen hybrid, or any cultivation practices or abilities on the farm.

ACKNOWLEDGEMENTS & COLLABORATION

- Data collection and analysis of the trials were done in collaboration with AgSci Unlimited Silage Consultancy, www.agsci.co.za, unlimited@agsci.co.za
- Farmers and contractors.

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KWAZULU-NATAL / EASTERN CAPE

AREA MANAGER	Jacques Minnaar	0663052461
AGRONOMIST	De Bruyn Myburg	0826988117
BERGVILLE / WINTERTON	Gary Wood	0828097326
BERGVILLE / WINTERTON	Eric Heinecken	0834680619
DUNDEE	Brian du Toit	0824604891
DUNDEE	Frikkie Bester (subagent)	0823234305
GREYTOWN / WEENEN	Jacques Minnaar	0663052461
KWAZULU-NATAL MIDLANDS	Jacques Minnaar	0663052461
SWARTBERG / KOKSTAD	Philip Mortlock	0824661120
SWARTBERG / UNDERBERG	Pip Mortlock (subagent)	0828260247
UGIE / MACLEAR / ELLIOT	Craig Lindsay	0832761202
UGIE / MACLEAR / ELLIOT	Philip Lindsay (subagent)	0833015260
VRYHEID / PAULPIETERSBURG	AP Keeve	0836791763

MPUMALANGA

AREA MANAGER	Gerhard Marais	0828067931
JUNIOR AGRONOMIST	PR Janse van Rensburg	0826352897
AMERSFOORT / VOLKSRUST	De Wet van den Berg	0837899252
BETHAL	Hannes Swanepoel (Snr)	0825559571
BETHAL	Hannes Swanepoel (Jnr) (subagent)	0721802298
ERMELO	Colin Odendaal	0820618284
HENDRINA / ERMELO	Heinz Oellermann	0828067496
MORGENZON / STANDERTON	Francois du Plessis	0823316572
PIET RETIEF	Sarel Nieuwenhuizen	0826809198

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AGRONOMIST	Martin Brandt	0823030698
BETHLEHEM / CLARENS / PAUL ROUX	Gideon Knobel	0836286477
FICKSBURG / CLOCOLAN / TWEESPRUIT	Ryk Neethling	0725271334
FOURIESBURG / FICKSBURG / CLARENS	Oosie Oosthuizen (Snr)	0646829459
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HARRISMITH / WARDEN	Maré Potgieter (subagent)	0836042608
LADYBRAND / EXCELSIOR / TWEESPRUIT / CLOCOLAN	Meyer Kotze	0829089994
LADYBRAND / EXCELSIOR / TWEESPRUIT / CLOCOLAN	Erik Faure (subagent)	0828951897
LESOTHO	Neil de Villiers	0825687055
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SENEKAL / WINBURG / STEYNSRUS	Louis Koch (subagent)	0736610452
VREDE	Hennie Janzen	0823228037

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DELMAS	Callie de Bruin	0824636759
DELMAS / GROOTVLEI / HEIDELBERG	Joppie Victor	0829446080
DELMAS / LEANDRA	Jaco Haasbroek	0824576810
HEIDELBERG	Hendrik de Wet	0825550442
HEIDELBERG	Henri Marais (subagent)	0837642404
HIGHVELD RIDGE	PM Erasmus	0823882148
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OGIES / WITBANK / DELMAS / EAST RAND	Kobus van Rooyen	0825248490

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AGRONOMIST	Philip Fourie	0829093262
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KOPPIES	LK Jonker	0827841666
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NORTH WEST

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SCHWEIZER-RENEKE	Gerrit van Niekerk	0836275162
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CRADOCK	Dawie Human	0832864943
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UPINGTON / KAKAMAS / GROBLERSHOOP	Jannes Gagiano	0847452992
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WESTERN FREE STATE

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