Dear PANNAR Customer

As a new season begins, we hope alongside you that 2019 will be the year for agricultural policy certainty. We look forward to an agriculture development path that is strong, inclusive and sustainable.

Amid all the current uncertainties, you can count on PANNAR to keep bringing you industry-leading products, services and technologies that fit your particular crop mix and farming practices. The excellent products featured in this catalogue are developed through the most innovative breeding techniques in the world, adapted and widely tested for local success.

Underpinning these products is our belief that there is no substitute for boots on farms - we are dedicated to forging close and collaborative relationships with farmers. We strive to earn your trust by doing what’s right and delivering solutions that meet your changing needs.

Thank you for allowing us the opportunity to step foot on your farm again this year and apply not only our products, but our accumulated knowledge and technological know-how to your fields.

We wish you every success on your farm this year.

Nick Goble
Commercial Manager
The Foundation of our Success

PANNAR is proud to support farmers and to partner with them to maximise farming enterprise profitability and growth.

Our Value Proposition is based on five key focus areas, summarised briefly as follows:

1. **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 with others.
   - **Be Upstanding:** We always do what’s right.
   - **Live Safely:** We embrace safety and the environment in all we do.

2. **ADVANCED TECHNOLOGY**
   PANNAR’s industry-leading, unique, multi-crop product portfolio is bolstered by the Corteva Agriscience™, the Agriculture Division of DowDuPont’s R&D pipeline of seed technologies and seed treatment and crop protection innovations.

3. **MULTI-CROP EXPERTISE**
   PANNAR’s package of cultivars offers performance, adaptability and stability for superior risk management. Coupled with our local expertise, we offer sound advice to farmers based on their unique needs.

4. **OPTIMISED PRODUCTION**
   We offer a range of exceptional agronomic support and development programmes to optimise crop productivity. This is carried out under the auspices of the PANACEA® (including YIELDBOOST™), PANAGRI® and SPROUT™ initiatives to support farmers with practical agronomic solutions to better manage their risks.

5. **BUSINESS PARTNERSHIP**
   Nobody understands the important role of the farmer as well as we do. We are proud to partner with farmers to help them grow their business. Together we feed a nation and help to leave a legacy for generations to come.
# Agriculture Division of DowDuPont™

The technology powerhouse behind PANNAR’s products.

## DIVISION OVERVIEW

**Name:** Agriculture Division of DowDuPont  
**Chief Operating Officer:** James C. Collins, Jr  
**Headquarters:** Wilmington, Delaware  
**Global Business Centers:**  
- Johnston, Iowa  
- Indianapolis, Indiana

### GLOBAL SCALE AND REACH

#### PURPOSE

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

#### BRAND 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.

#### KEY CAPABILITIES:

- Greatly expanded product and service offering with robust combined pipeline across seed germplasm, biotech traits, crop protection, seed-applied technologies and digital agriculture.  
- World-class R&D capabilities developing promising new technologies, creating innovative agricultural solutions and collaborating across the value chain.  
- Optimised global supply chains and customer-oriented routes to market.

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### GLOBAL LEADER IN PRODUCTION AGRICULTURE

<table>
<thead>
<tr>
<th>PEOPLE STRONG</th>
<th>COUNTRIES</th>
<th>CROPS</th>
<th>ACTIVE INGREDIENTS</th>
<th>PRODUCTION AND MANUFACTURING FACILITIES</th>
<th>RESEARCH AND DEVELOPMENT FACILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>20,000+</td>
<td>130+</td>
<td>10+</td>
<td>65+</td>
<td>100+</td>
<td>140+</td>
</tr>
</tbody>
</table>

1 Figure represents approximate number of global seed and crop protection production and manufacturing facilities.  
2 Approximate based on 2017 pro-forma net sales.

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### INDUSTRY-LEADING CAPABILITY TO ENABLE HIGHEST-PERFORMING COMPANY IN PRODUCTION AGRICULTURE.

- **DIGITAL BREEDING**  
- **TARGETED BREEDING**  
- **BIOTECH**  
- **CROP PROTECTION**  
- **SEED APPLIED TECHNOLOGY**  
- **DIGITAL SOLUTIONS**  
- **AGRONOMIC SOLUTIONS**

**Solving customer challenges** with a broader product and service offering.  
**World-class unified R&D** capabilities driving agricultural innovation, promising new technologies and a robust pipeline.
HYBRID SELECTION

One of the most important and difficult management decisions that farmers make every year is the selection of a package of hybrids to plant. When selecting a suitable hybrid package, yield performance and mitigating risk are both important considerations. This is complemented by the hybrid’s agronomic characteristics and disease tolerance attributes.

The criteria that a farmer sets for a hybrid will vary from farm to farm. Certain hybrid characteristics are important, regardless of where those hybrids are planted. The following characteristics, not necessarily in order of importance are key considerations in the decision-making process:

- Yield performance, stability and compensation ability
- Hybrid package
- Growing season length
- Prolificacy – multi-eared or single eared
- Standability
- Germination and vigour
- Disease, insect tolerance and weed control

The most desirable characteristics are discussed in short:

Yield performance, stability and compensation ability:
Reliability of yield expectation from season to season is probably the most important aspect of hybrid choice. Success depends on risk mitigation and it is determined by how accurately a hybrid’s yield prediction can be made. The chance of success improves significantly if hybrid choice is based on multi-season results across multiple locations.

Adaptability and stability are extremely important when choosing any hybrid. A hybrid that can deliver above-average returns under both favourable as well as adverse climate conditions will spread your risk. Choose hybrids that are stable over various environments and seasons, as it is difficult to predict the growing conditions of a coming season.

Hybrid package:
Despite the best efforts on the part of maize breeders, there is no one ideal hybrid. Therefore, a package of hybrids is recommended to spread the risk and increase the potential for the best yield under the prevailing circumstances. A hybrid package is constructed from various hybrids (different genetics, resistance properties, disease tolerances, etc.) and preferably with varying growing season lengths.

The yield and adaptability of a hybrid is the result of the interaction between a hybrid’s genetics and the environmental factors and management practices that are applied, for example:
- Planting date
- Rainfall distribution
- Stress factors e.g. drought stress, damage due to diseases, insects or hail
- Crop rotation programme
- Fertilisation, soil fertility and soil type
- Cultivation practices
- Weed control

Growing season length:
To ensure the best average yield, consider planting hybrids of varying maturity. This reduces the probability that the entire crop will experience hot and dry conditions during the critical pollination period. This will be an advantage if planting is completed over a short period to fit in with the optimum planting window. If planting takes place over a long period, hybrids with different maturity groups is less important.

Under dryland conditions hybrids in the earlier growth classes are generally better adapted in the cooler regions with limited
heat units and higher plant populations. In the warmer, drier production regions, a combination of hybrids from medium to medium early growing season are better adapted. A package also offers the advantage that everything is not combine-ready at the same time. Early maturity hybrids also give the opportunity to bank your money earlier.

Under high input irrigation and double cropping systems (high yield targets, water application and management input) the ultra early hybrids are the best adapted.

**Standability:**
Good standability facilitates effective combine harvesting. The primary causes of reduced standability are root and stem rot. If root and stem rot is noticed, it is advisable to combine infected fields early to limit losses by lodging of the plants, if drying facilities are available.

**Germination and vigour:**
Rapid germination and a strong seedling lays the foundation of a successful crop. Early vigour is particularly important on sandy soils where wind damage to seedlings may occur. There are marked differences between hybrids with respect to early vigour.

**Disease, insect tolerance and weed control:**
By maintaining healthy leaves the plant’s factory can function more effectively, increasing the chance of good results. The risk profile of hybrids to important diseases is evaluated and plays an important role in area adaptability. Leaf diseases caused by fungal infections are usually more prevalent in the high rainfall production regions; a fungicide spray programme may play an important role in protecting the yield potential. Bacterial diseases and vector-transmitted viral infections must be managed in other innovative and preventive ways. The weed spectrum determines which herbicides should be applied as well as the hybrids that can be planted. Hybrids with glyphosate tolerance provide broad spectrum weed control. Keep in mind that tolerance to the harder herbicides (such as sulfonylurea) differs between hybrids. Read and adhere to herbicide prescriptions and check the tolerance of the hybrid against the planned herbicide programme.

**In summary, some basic guidelines:**
- Select hybrids that are proven performers based on multi-season data from multiple trials across a large homogeneous area. It is about yield performance, stability and adaptability.
- New hybrids should be phased in gradually.
- Select a package of hybrids with a variety of maturity or growth classes to spread the risk.
- Include early growing season hybrids in your package if early harvesting is important.
- Consider Bt-hybrids if plantings are going to be late in the season.
- Prolific hybrids should be considered in the dryland areas with a variable or challenging climate and will generally deliver stable yields.
- Single-eared hybrids are better adapted to high plant populations and higher potential conditions.
MAIZE PRODUCTION – DEVELOPMENT & MANAGEMENT

### Growth Stage: Planting

- **Stage**
  - **VO** Emergence and establishment of plant population
  - **V5** Yield potential determined
  - **V12-V17** Yield potential fixed
  - **VT-R1** Actual kernel number and size determined
  - **R3-R6** Kernel weight determined

#### Days after emergence and height of plant

<table>
<thead>
<tr>
<th>Stage</th>
<th>Days after emergence and height of plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V0</td>
</tr>
<tr>
<td></td>
<td>Emergence</td>
</tr>
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<td></td>
<td>0 cm</td>
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#### Rate of water, nitrogen, phosphorus and potassium use by maize

<table>
<thead>
<tr>
<th>Rate of water, nitrogen, phosphorus and potassium use by maize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days after emergence</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>V0</td>
</tr>
<tr>
<td>V2</td>
</tr>
<tr>
<td>V5</td>
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<tr>
<td>V8-V10</td>
</tr>
<tr>
<td>V12-V17</td>
</tr>
<tr>
<td>VT-R1</td>
</tr>
<tr>
<td>R2-R4</td>
</tr>
<tr>
<td>R3-R6</td>
</tr>
</tbody>
</table>

- **GROWTH STAGE: PLANTING**
  - The environmental potential of an area influences the choice between single-eared hybrids, better adapted to high plant population high potential conditions and prolific hybrids more suited to lower plant populations and areas with varying climatic conditions. Generally, prolific hybrids tend to be more yield stable.
  - In the case of late planting dates, Bt-hybrids with stalk borer protection are recommended. The risk of stalk borer infection with later plantings is often higher.
  - Planting time is primarily determined by soil temperature and soil moisture status. The expected flowering date may also influence planting date. One may choose to delay planting, for example, to avoid flowering during an expected unfavourable climatic event that generally occurs later in the season.
  - Optimum germination of maize takes place between 18-30°C. At 12°C and 25°C, seedlings emerge approximately at 14 and 5 days respectively.
  - Germination takes place when the seed has absorbed at least 30% of its weight in moisture and soil temperature is above 12°C.
  - In reduced tillage systems, strip tillage gives the advantage of a warmer seedbed in the rows. The row should be clean without any stover allowing the soil in the strip to warm up more rapidly than un-tilled soil.
  - Uniform planting depth, spacing and consistent soil moisture ensures even emergence and reduced inter-plant competition. This allows each plant to contribute meaningfully towards grain production and ultimately yield.
  - Good seed contact with the soil and available moisture is a function of planting depth and pressure wheel adjustment.
  - Banded fertiliser ensures access to nutrients in the early stages of root development and improves early vigour, giving a popup effect to seedlings.
  - Apply fertiliser based on yield potential, soil analysis, previous crop and cultivation history.
  - Fertiliser, particularly phosphorous, applied in a band stays in a plant-available form for longer than broadcast fertiliser.

- **Critical moisture requirement**
  - Weed control
  - Tap dressing
  - Top dressing

- **Calibrate and test plantability of seed.**
- **Ideal planting speed is ±5.5 km/h.**
- **Avoid planting in wet soils as a smear action and sidewall compaction can take place.**
- **Check the calibration of each planter unit regularly. Clean seed bins regularly.**
- **Regularly open rows to check the depth and spacing of seed and fertiliser.**
- **Place fertiliser at least 5 cm deeper and 5 cm away from the seed to prevent chemical burn.**
- **In 2.1 m rows, no more than 40 kg/ha N and K should be band placed, because of the risk of chemical burn damage to the seed.**
- **In 2.1 m rows, no more than 40 kg/ha N and K should be band placed in the row.**
- **Weed control is essential during the first six weeks of the crop’s development.**
- **Use pre- and post-emergence herbicides to control grasses and broadleaf weeds.**
- **Control cutworm, wireworms, Astyllus larvae, black maize beetle, snout beetles and nematodes.**
- **Soil cultivation is important for root development and water management. Break up any compaction layers.**
- **Manage sandy soils correctly as they tend to compact quickly. A rip cultivation is advantageous to encourage good root development.**
- **Irregular emergence can mean a yield loss of 6-9% if seedlings emerge ten days later.**
- **If 25% of plants do not emerge, 10% of the yield is lost.**
- **A plant population loss of 50% means a 30% yield loss.**
**GROWTH STAGE: V0**  
**Leaf emerges above soil level**
- Emergence and establishment of the plant population.
- Rapid and even emergence plus good plant population and strong plants equals YIELD.
- Emergence takes place seven to ten days after planting, depending on the temperature.
- Germination percentage determines the final plant population.
- The plant population determines the potential harvestable cobs.
- Weak plants are unable to compete.
- The growth point is 25-35 mm below the soil surface.
- The growth point remains below ground for about three weeks.
- While the growth point is underground, damage by hail and frost may not have a major impact on the yield, although it will slow plant development.

**MANAGEMENT GUIDE:**
- Good weed control is essential during the early stages of plant development.
- Be attentive to crust formation after a thunderstorm.
- Roll to break up the crust and aerate the soil.
- Pay attention to strong winds that may cause wind damage.
- Bear in mind possible leaching of fertiliser after heavy showers.
- Cold conditions delay seedling development and leaves may turn purple. Phosphate is less available at low soil temperatures.
- Grass herbicide damage is associated with cold, wet conditions. The coleoptile of damaged plants will be shaped like a corkscrew.
- Seedlings that take too long to emerge are more susceptible to head and tassel smut infection.
- Waterlogging may cause major losses (>48h).
- Hail and frost damage may slow development. It usually does not cause any damage, as the growth points are still underground.

**GROWTH STAGE: V5**  
**Yield potential determined**
- This is the first important period regarding yield potential determination.
- Cob and tassel initiation takes place – the number of cobs per plant and kernel rows per cob is determined.
- While hybrid genetics have a significant influence on the number of cobs and kernel rows per cob, growing conditions at this stage can have an impact on this genetic expression.
- A new leaf appears every three to four days.
- The growth point is near or just above the soil surface.
- The secondary or nodal root system is established and becomes the main functional root system.
- Hair roots are visible on the secondary roots.
- Tillers start to develop.
- The plant begins to absorb large amounts of nutrients; it is a good time to apply a nitrogen side dressing.
- The roots that develop from the seed are called the primary or first root system, while the main or secondary root system develops from the plant’s first few stem internodes. The terminology therefore only indicates the chronological order of root development.

**MANAGEMENT GUIDE:**
- Apply nitrogen side dressing (up to V8).
- Stress or damage caused by weed pressure, hail, wind, waterlogging and leaf feeding insects can limit the number of kernel rows on the cob.
- It is very important to avoid stress due to weed competition.
- Mechanical weed control too deep or too close to the plant can damage roots.
- Root damage can lead to stem and root rot, followed by lodging of plants later in the season.
- Stress like drought at this stage is detrimental to vegetative growth (smaller plants), but not necessarily to the yield.
- If leaf diseases are a problem, use fungicides to protect the maize plant and the yield potential.
- The ideal time to apply the first fungicide spray.
- Fungicides provide protection for 14 to 21 days after spraying.
- If plants are killed by frost, 100% damage can occur.
- If hail destroys all the leaves, yield losses of 10-20% can be expected.
- With the growing point below the ground, waterlogged conditions can cause major losses, especially if it is accompanied by hot conditions.

**GROWTH STAGE: V8-V10**  
**Active growth, the “factory” is developing**
- The growth point is now above the ground, developing tassel is ±15 cm above soil.
- The stalk enters a period of rapid elongation.
- The plant develops rapidly with new leaves appearing every three days.
- Tillers start to develop and the bottom leaves begin to tear off the lower nodes of the stalk.
- A potential cob develops on each internode above the ground except for the top six or eight nodes.
- Usually only the top two ears produce grain. The top cobs begin rapid development.
- Single-eared hybrids give preference to the development of the upper ear.
- The secondary or nodal roots are well-established and are now the main root system.
- The root system is well developed and should be more than 50 cm deep and spread in a radius of 60 cm around the plant.
- The plant enters a phase where nutrients and dry matter accumulate rapidly.
- The demand for nutrients and water is relatively high.
- At the V10 stage a new leaf will appear every two to three days.

**MANAGEMENT GUIDE:**
- Nitrogen side dressing should be completed in time for when the final yield potential is determined during the V12 to V17 growth stages.
- Make sure there are no nutritional deficiencies at the V8 stage.
- Phosphate and potassium are needed close to the roots as these nutrients move very little in the soil.
- Macro- and micro-element deficiencies may occur.
- Dry soil conditions can inhibit nutrient uptake.
- Nutritional deficiencies can limit leaf development.
- In early plantings, the first generation of stalk borer can make their appearance – scout fields regularly.
- Crop protection chemicals applied after the V8 stage (especially sulphonylurea and glyphosate) and non-ionic surfactants (NIS) can reduce the number of kernel rows on the cob and cause barren tips.
- If glyphosate needs to be applied, make use of drop arms to deliver a directed spray away from plant funnels.
- If all the unfolded leaves are removed by hail or frost, it may result in a 20-40% yield loss.
- Flooding and waterlogging during the later growth stages with the growth point above the ground are not as detrimental to the yield.
### MAIZE PRODUCTION - DEVELOPMENT & MANAGEMENT

#### Continued

<table>
<thead>
<tr>
<th>GROWTH STAGE: V12-V17</th>
<th>MANAGEMENT GUIDE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield potential fixed per row</td>
<td>Tillage between the rows will destroy the plant roots and create a breeding ground for fungi to infect the plant that can lead to lodging later in the plant’s life.</td>
</tr>
<tr>
<td>The yield potential, cob size and number of potential kernels is determined.</td>
<td>Any nutrient or moisture deficiency or damage (hail and insect) may inhibit leaf development and reduce the number of kernels that should develop.</td>
</tr>
<tr>
<td>These two key components of yield are determined in the period V12-V17.</td>
<td>Stress in the late vegetative stages can limit silk development more than tassel development and upset the synchronization.</td>
</tr>
<tr>
<td>The number of ovules from where the silks will develop, i.e. the number of kernels is determined.</td>
<td>This may cause pollen to shed before all the silks have appeared.</td>
</tr>
<tr>
<td>The number of heat units per day and growing season length of the hybrid determines the length of time the plant will take to develop from V10-V17.</td>
<td>Prolific multi-eared hybrids usually produce more stable yields under stress conditions or varying climatic conditions.</td>
</tr>
<tr>
<td>The duration in this period determines the potential yield.</td>
<td>Single-eared hybrids, however, can often out-yield prolific hybrids under high potential conditions.</td>
</tr>
<tr>
<td>Higher plant populations are required for early hybrids to produce similar yields to hybrids in later growth classes.</td>
<td>Plants that develop vigorously in the vegetative stage and experience stress in the grain filling period are more likely to develop stem and root rot.</td>
</tr>
<tr>
<td>Brace roots develop from the fifth internode and first few internodes above the soil surface.</td>
<td>Avoid the application of fungicides and surfactants during the V10-VT growth stages as it may increase the risk of developing Arrested Ear Syndrome (AES).</td>
</tr>
<tr>
<td>Brace roots can grow to a depth of more than 1.5 m - they stabilize the plant and extract water and nutrients from the soil during the reproductive stage.</td>
<td>Moisture stress can result in crop losses of 3% per day.</td>
</tr>
<tr>
<td>At the V14-V15 stage the tassel is almost fully developed, although it is not yet visible above the plant.</td>
<td>If all the leaves are destroyed by hail, a 40-60% crop loss can be experienced. This is also applicable to leaf area loss by diseases or red spider mites.</td>
</tr>
<tr>
<td>Silks also begin to develop in the upper ear, which develops faster than the other shoots on the stalk.</td>
<td>Early hybrids may experience greater yield damage compared to longer growing season hybrids, when leaves are damaged.</td>
</tr>
<tr>
<td>Stem development also occurs faster due to the elongation of internodes, from the bottom node to the top.</td>
<td>In the case of 50% leaf loss, 20-30% yield losses may be incurred.</td>
</tr>
<tr>
<td>A new leaf develops approximately every three days.</td>
<td>This may cause pollen to shed before all the silks have appeared.</td>
</tr>
<tr>
<td>At low plant populations, tillers can develop abundantly under favourable conditions.</td>
<td>Moisture and nutritional deficiencies can lead to poor pollination.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GROWTH STAGE: VT-R1</th>
<th>MANAGEMENT GUIDE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollination - actual kernel number and potential kernel size determined</td>
<td>Optimum conditions during this period, two weeks before and up to four weeks after flowering, is critical for good yield results - especially when it can be managed with irrigation.</td>
</tr>
<tr>
<td>VT (appearance of the tassel) usually takes place two to three days before the silks appear.</td>
<td>This period is the most effective time to apply irrigation if water availability is restricted.</td>
</tr>
<tr>
<td>The plant is fully developed and pollen shedding starts - this is the end of the vegetative stage.</td>
<td>Shortage of potassium can contribute to barren tips on the cobs.</td>
</tr>
<tr>
<td>Pollen shedding usually takes place in the morning or late afternoon.</td>
<td>Nutrient content in a leaf analysis correlates well with the nutrient content in a plant.</td>
</tr>
<tr>
<td>The timing between VT and R1 (silk appearance) differs between hybrids and is also determined by environmental conditions.</td>
<td>Nutrient imbalances and especially low levels of potassium and high levels of nitrogen enhance the potential of lodging.</td>
</tr>
<tr>
<td>Silks grow 25-40 mm a day.</td>
<td>High nitrogen levels increase lush vegetative growth, while low potassium levels give rise to premature stalk death. Together these conditions create an ideal situation for stalk rot and lodging.</td>
</tr>
<tr>
<td>Moisture or nutrient deficiencies can lead to poor pollination.</td>
<td>Worm and hail damage to the maize cob can lead to secondary infection of fusarium or fungi.</td>
</tr>
<tr>
<td>The maize plant is the most sensitive to stress conditions during the period when the silks appear (R1) and may potentially suffer the largest yield reduction.</td>
<td>Moisture and nutritional deficiencies can lead to poor pollination and seed set.</td>
</tr>
<tr>
<td>Moisture stress will shorten the period of pollen shedding and delay silk development.</td>
<td>Hail damage can seriously harm the yield.</td>
</tr>
<tr>
<td>If the synchronization between pollen and silk appearance is out, it may cause poor pollination and seed set.</td>
<td>100% leaf loss by hail or leaf diseases could result in a total crop failure.</td>
</tr>
<tr>
<td>If tillers are present, they can serve as a source of pollen and pollinate the plants.</td>
<td>Moisture stress or potassium deficiencies can cause abscission of the kernels at the tip of the cob and result in a poor bushel weight.</td>
</tr>
<tr>
<td>A pollen grain grows down the silk and fertilizes the ovule, the process takes about 24 hours.</td>
<td>Moisture stress where the leaves curl in early in the day can result in crop losses of 7-10% per day.</td>
</tr>
<tr>
<td>With fertilisation, the ovule becomes a kernel.</td>
<td>Nutrient content in a leaf analysis correlates well with the final grain yield.</td>
</tr>
<tr>
<td>All the silks on an ear are pollinated in about two to three days - the environment plays a role.</td>
<td>Avoid deep tillage operations as it could lead to stem and root rot, resulting in poorer yields and lodging of plants.</td>
</tr>
<tr>
<td>The root system has almost reached the maximum root mass.</td>
<td>Synchronize planting dates for dryland in western production regions with the long-term climate data to coincide with optimum growing conditions during the flowering period.</td>
</tr>
<tr>
<td>Potassium uptake is almost complete and plays an important role during pollination and grain filling.</td>
<td>Nitrogen and phosphorus uptake is accelerated. Total nitrogen uptake has reached 65% and phosphorus uptake 50% as soon as the maize plant begins to flower.</td>
</tr>
</tbody>
</table>
KEY MANAGEMENT ISSUES

- The most important element of crop cultivation is to get the basics right from the beginning. Once the basics are accomplished, practices can be fine-tuned to achieve top returns.
- Secure marketing contracts before planting. Fulfil specific quality requirements of niche market end users.
- Plant hybrids that have the desired characteristics for your conditions and targeted end use market.
- Select a cultivar package. Take note of cultivar’s yield potential and yield reliability and match cultivars to a realistic field potential.
- Land selection. Consider the field’s history with regard to the previous crops harvested, harvested yields (water consumption), weed control and chemicals applied. Consider the possibility of chemical residual carryover as well as the expected weed spectrum to be addressed.
- Set a target yield based on moisture availability and match inputs to the targeted yield (use the field’s history as a starting point).
- Adjust the plant population and row spacing to match the yield target and environment.
- Select the planting time to coincide with optimal germination temperatures and soil moisture conditions. Also, try to avoid early frost damage and extreme heat and drought stress during flowering.
- For irrigated crops, calculate water budgets, matching the crop area to water allocation. Attempt to maintain optimal growing conditions during pollination and grain filling stages.
- The planting process is the foundation of success and the goal is to achieve even emergence and minimise interplant competition. Adjust the pressure wheels to match the soil and soil moisture conditions.
- Apply nitrogen, phosphate and potassium fertiliser based on target yields, soil tests and previous crop yields.
- Use controlled traffic or conservation tillage to reduce soil compaction (maize is relatively susceptible to compaction), improve moisture management and reduce fuel costs, especially in the case with sandy soils.
- Protect the yield potential. Where leaf diseases occur annually, use a fungicide spray programme to protect the maize “factory”.
- Effective pest control - regular scouting for disease and insect pests is essential for success.
- Apply quality control regularly and without exception and, if possible, take corrective action. By focusing on efficiency and timing it is possible to optimise growth and production for better returns.
- Your footsteps in your fields are the best management practices that exist.

USE OUR EXPERTISE AND SERVICE. WE ARE PASSIONATE AGRICULTURALISTS WHO TAKE A PERSONAL INTEREST IN THE SUCCESS OF YOUR FARM. WE PRIDE OURSELVES ON PROVIDING HONEST, RELIABLE TECHNICAL ADVICE, A COMPLETE SEED LINE-UP AND MANAGEMENT GUIDELINES FOR OPTIMISED CROP PRODUCTION.

GROWTH STAGE: R2-R4

**Kernel development and starch accumulation**

- R2 is the blister stage.
- Silks begin to discolor.
- The plant begins to accumulate carbohydrates in the endosperm.
- Transfer of nutrients from the stems and leaves to the kernels for storage as starch.
- The initial phase where solids start to accumulate rapidly in the cob.
- R3 is the milk stage and kernels start colouring – yellow maize starts to appear yellow.
- Cell division in the endosperm is complete and kernels become larger as a result of cell expansion and starch accumulation.
- R4 is the dough stage, the kernels have stored about 50% dry matter and the moisture content is about 70%.

**MANAGEMENT GUIDE:**

- In this active development stage of the kernels, stress can result in unfilled kernels that are packed loosely on the ears.
- It is important to protect the plants from disease and keep them green as long as possible.
- This ensures that the plant develops normally in each of the reproductive stages for maximum dry matter accumulation.
- Frost damage in the R4 stage can cause a yield loss of 35-50%.
- Drought stress in the hard-dough stage will cause the cob to hang prematurely and/or abortion of kernels at the tip of the cob.

GROWTH STAGE: R5-R6

**Kernel weight determined**

- R5 is known as the dent stage and the milk line is visible on the side of the kernel.
- The milk line moves to the tip of the kernel as it becomes more mature. Accumulated starch is hard above the line and soft below the line.
- The moisture content of kernels is about 55% and the seed embryo is morphologically mature.
- At the R6 stage, the kernels are mature and have accumulated the maximum dry mass.
- The starch line moves to the tip of the kernel and forms a brown or black layer at the base of the kernel.
- The black layer indicates physiological maturity and husk leaves have coloured brown.
- With the development of the black layer, the moisture content of the kernel is about 35%.
- The drying period is determined by the type of hybrid, grain type and humidity of the environment.
- At 20-25% moisture the grain can be harvested and dried.
- At 12-15% moisture content, the grain can be stored safely.

**MANAGEMENT GUIDE:**

- Water application can be discontinued as soon as at least 80% of the husk leaves have turned brown.
- The 50% milk line stage is ideal to cut silage.
- Ensil e for maximum starch when the milk line is two thirds of the way to the tips of the kernels. The crop has reached about 35% DM content.
- Severe moisture stress, hot temperatures or early frost during grain fill can cause premature setting of the black layer. Even if conditions improve, nutrients will no longer be transferred.
- Frost damage in the R5 stage can result in up to 20% yield loss.
- Diplodia cob rot can enter the cob during grain filling or after physiological maturity.

"Apply quality control regularly and without exception and, if possible, take corrective action. By focusing on efficiency and timing it is possible to optimise growth and production for better returns.

Your footsteps in your fields are the best management practices that exist."
DRIYLAND EASTERN PRODUCTION REGION

PANNAR’s maize package comprises various growth classes and includes conventional, stalk borer resistant, glyphosate herbicide tolerant and stacked gene hybrids that incorporate both genes. These hybrids are recommended for grain and silage production, as well as maize foggage.

NB! The management of possible insect resistance to the Bt gene is legally binding. The planting of a refuge according to regulations is required where any Bt hybrids are used (B or BR). Refer to the schematic guidelines on page 30.

The high potential eastern production region, which includes the West Rand, Eastern Highveld, KwaZulu-Natal and the cooler parts of the Eastern Cape, is humid, potentially leading to a higher incidence of disease.

In these production areas, it is advisable to inspect plantings regularly for plant diseases and spray if necessary. PANNAR’s YIELDBOOST® fungicide spray programme is a cost-effective management system that can protect the yield potential of certain hybrids in these areas.

A package made up of hybrids from the various growth classes is recommended for good risk distribution.

NOTES
REGIONAL RECOMMENDATIONS AND HYBRID PACKAGE COMPOSITION

The following regional recommendations are based on PAN-NAR’s perennial trial results. The graphs and tables below summarise the growth classes and hybrids recommended per region. This information can be used in conjunction with the regional map, agronomic characteristics and plant population recommendations to select the best hybrid combinations. Please consult your regional sales representative for the best fit for your specific requirements.

**Cool Mpumulanga (Region 1)**

**White Hybrid Package**
- **Growth Class**: Ultra Early
  - PAN 3A-173
  - PAN 3R-573R
- **Growth Class**: Early
  - PAN 4A-111
  - PAN 4R-511R
  - PAN 4R-711BR
- **Growth Class**: Medium Early
  - PAN 5A-291
  - PAN 5R-591R
  - PAN 5R-891BR
  - BG 528R
  - BG 568R
  - PAN 5B-485B
  - PAN 5R-785BR

**Yellow Hybrid Package**
- **Growth Class**: Ultra Early
  - PAN 3A-173
  - PAN 3R-573R
- **Growth Class**: Early
  - PAN 4A-111
  - PAN 4R-511R
  - PAN 4R-711BR
- **Growth Class**: Medium Early
  - PAN 5A-182
  - PAN 5A-190
  - PAN 5R-590R
  - PAN 5R-554R

**Eastern Free State (Region 1)**

**White Hybrid Package**
- **Growth Class**: Ultra Early
  - PAN 4A-111
  - PAN 4R-511R
  - PAN 4R-711BR
- **Growth Class**: Early
  - PAN 5R-591R
  - PAN 5B-485B
  - PAN 5R-785BR
- **Growth Class**: Medium
  - PAN 6C-865BR

**Mist Belt and East Griqualand (Regions 1 & 3)**

**White Hybrid Package**
- **Growth Class**: Ultra Early
  - PAN 3A-173
  - PAN 3R-573R
- **Growth Class**: Early
  - PAN 4A-111
  - PAN 4R-511R
  - PAN 4R-711BR
- **Growth Class**: Medium Early
  - PAN 5R-785BR

**Yellow Hybrid Package**
- **Growth Class**: Ultra Early
  - PAN 3A-173
  - PAN 3R-573R
  - PAN 3R-700BR
- **Growth Class**: Early
  - PAN 4A-116
  - PAN 4A-172
  - PAN 4R-627R
  - PAN 4R-728BR
  - PAN 4R-776BR
- **Growth Class**: Medium Early
  - PAN 5A-142
  - PAN 5A-190
  - PAN 5R-590R
  - PAN 5R-554R
- **Growth Class**: Medium
  - PAN 6B-610B
  - PAN 6B-680R
  - PAN 6B-710BR

**Temperate Highveld (Region 2)**

**White Hybrid Package**
- **Growth Class**: Ultra Early
  - PAN 3A-173
  - PAN 3R-573R
- **Growth Class**: Early
  - PAN 4A-111
  - PAN 4R-511R
  - PAN 4R-711BR
- **Growth Class**: Medium Early
  - PAN 5R-785BR

**Yellow Hybrid Package**
- **Growth Class**: Ultra Early
  - PAN 3A-173
  - PAN 3R-573R
  - PAN 3R-700BR
- **Growth Class**: Early
  - PAN 4A-116
  - PAN 4A-172
  - PAN 4R-627R
  - PAN 4R-728BR
- **Growth Class**: Medium Early
  - PAN 5A-142
  - PAN 5A-190
  - PAN 5R-590R
  - PAN 5R-554R
- **Growth Class**: Medium
  - PAN 6B-610B
  - PAN 6B-680R
  - PAN 6B-710BR

**Northern KwaZulu-Natal (Region 2)**

**White Hybrid Package**
- **Growth Class**: Ultra Early
  - PAN 3A-173
  - PAN 3R-573R
- **Growth Class**: Early
  - PAN 4A-111
  - PAN 4R-511R
  - PAN 4R-711BR
- **Growth Class**: Medium Early
  - PAN 5A-291
  - PAN 5B-485B
  - PAN 5R-785BR

**Yellow Hybrid Package**
- **Growth Class**: Ultra Early
  - PAN 3A-173
  - PAN 3R-573R
  - PAN 3R-700BR
- **Growth Class**: Early
  - PAN 4A-116
  - PAN 4A-172
  - PAN 4R-627R
  - PAN 4R-728BR
- **Growth Class**: Medium Early
  - PAN 5A-142
  - PAN 5A-190
  - PAN 5R-590R
  - PAN 5R-554R
- **Growth Class**: Medium
  - PAN 6B-610B
  - PAN 6B-680R
  - PAN 6B-710BR
### WHITE HYBRID PACKAGE – DRYLAND EASTERN REGION

The PANNAR white hybrid package is characterised by good performance, adaptability and stability for good risk management. The white package has exciting new top performers added for the coming season. In the dryland eastern region, the PAN 3A-173 and PAN 4A-111 platforms form the backbone of the PANNAR package.

<table>
<thead>
<tr>
<th>Growth Class</th>
<th>Hybrid</th>
<th>Plant Population per ha (’000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temperate</td>
<td>Low Pot.</td>
</tr>
<tr>
<td></td>
<td>Mist Belt</td>
<td>Low Pot.</td>
</tr>
<tr>
<td></td>
<td>PAN 3R-573R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAN 4B-311B</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>PAN 4R-511R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAN 4R-711BR</td>
<td></td>
</tr>
<tr>
<td>Medium Early</td>
<td>BG 5285</td>
<td>25 – 40</td>
</tr>
<tr>
<td></td>
<td>BG 5685R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAN 5B-485B</td>
<td>25 – 40</td>
</tr>
<tr>
<td></td>
<td>PAN 5R-785BR</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>PAN 5A-291</td>
<td>25 – 40</td>
</tr>
<tr>
<td></td>
<td>PAN 5B-491B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAN 5R-591R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAN 5R-791BR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAN 5R-891BR</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>PAN 6R-579R</td>
<td>25 – 40</td>
</tr>
<tr>
<td></td>
<td>PAN 6R-779BR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAN 6Q-865BR</td>
<td></td>
</tr>
</tbody>
</table>

**Main planting, highly recommended**  **Strategic hybrid, supplementary planting**  *Potential

### WHITE HYBRIDS AGRONOMIC CHARACTERISTICS - EASTERN DRYLAND

<table>
<thead>
<tr>
<th>Growing Season Class</th>
<th>PAN 3A-173</th>
<th>PAN 4A-111</th>
<th>PAN 4B-311B</th>
<th>PAN 4R-511R</th>
<th>PAN 4R-711BR</th>
<th>PAN 5A-291</th>
<th>PAN 5B-485B</th>
<th>PAN 5R-785BR</th>
<th>PAN 5R-891BR</th>
<th>PAN 6R-779BR</th>
<th>PAN 6Q-865BR</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Relative number of days to 50% tassel</em></td>
<td>56</td>
<td>58</td>
<td>60</td>
<td>60</td>
<td>63</td>
<td>64</td>
<td>64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Relative number of HU to 50% tassel</em></td>
<td>670</td>
<td>708</td>
<td>715</td>
<td>715</td>
<td>725</td>
<td>735</td>
<td>735</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximate days to harvest (&lt;15% moisture) (Influenced by prevailing humidity)</td>
<td>105</td>
<td>115</td>
<td>116</td>
<td>116</td>
<td>120</td>
<td>127</td>
<td>127</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Yield Dryland
(1) Cool Eastern Production Regions
(2) Temperate Eastern Production Regions
(3) KwaZulu-Natal Mist Belt
(6) North Eastern Free State

<table>
<thead>
<tr>
<th>General Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying Rate</td>
</tr>
<tr>
<td>Tilling</td>
</tr>
<tr>
<td>Prolificacy</td>
</tr>
<tr>
<td>Standability</td>
</tr>
</tbody>
</table>

**Disease Risk**

<table>
<thead>
<tr>
<th>Northern Corn Leaf Blight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey Leaf Spot</td>
</tr>
<tr>
<td>Common Rust</td>
</tr>
<tr>
<td>Phaeosphaeria Leaf Spot***</td>
</tr>
<tr>
<td>Diplodia Cob Rot</td>
</tr>
<tr>
<td>Cob and Tassel Smut</td>
</tr>
</tbody>
</table>

**Herbicide Sensitivity**

<table>
<thead>
<tr>
<th>Sulfonylurica</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield Potential</td>
</tr>
<tr>
<td>Good</td>
</tr>
</tbody>
</table>

12
### YELLOW HYBRID PACKAGE – DRYLAND EASTERN REGION

This formidable yellow maize package of ultra early, early and medium hybrids offers a good long-term risk mitigating strategy. The ultra early package has been reinforced with three new exceptional genetic platforms, PAN 3R-724BR, PAN 3R-786BR and PAN 3R-700BR, offering a substantial yield increase. These new genetic platforms are an excellent choice for the high potential dryland production regions.

The early to medium growth classes see the addition of four new exciting hybrids to bolster the PANNAR yellow package. In particular; the PAN 5A-182, PAN 4R-672R and PAN 6R-710BR platforms delivered outstanding performance in the past production season.

### YELLOW HYBRIDS AGRONOMIC CHARACTERISTICS - EASTERN DRYLAND

<table>
<thead>
<tr>
<th>Growing Season Class</th>
<th>Hybrid</th>
<th>Ultra Early</th>
<th>Early</th>
<th>Medium Early</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm Weather Areas</td>
<td>54 76</td>
<td>68 80</td>
<td>67 81</td>
<td>72 75</td>
<td>73 82</td>
</tr>
<tr>
<td>Cool Weather Areas</td>
<td>53 75</td>
<td>65 81</td>
<td>64 72</td>
<td>72 75</td>
<td>73 82</td>
</tr>
<tr>
<td>Approximate days to</td>
<td>105 145</td>
<td>165 180</td>
<td>165 180</td>
<td>165 180</td>
<td>165 180</td>
</tr>
<tr>
<td>harvest (&lt;15% moisture)</td>
<td>104 143</td>
<td>163 178</td>
<td>163 178</td>
<td>163 178</td>
<td>163 178</td>
</tr>
<tr>
<td>Shaded Weather Areas</td>
<td>56 78</td>
<td>69 80</td>
<td>69 70</td>
<td>70 71</td>
<td>71 72</td>
</tr>
<tr>
<td>Wet Weather Areas</td>
<td>57 78</td>
<td>69 70</td>
<td>69 70</td>
<td>70 71</td>
<td>71 72</td>
</tr>
</tbody>
</table>

#### Drying Rate

<table>
<thead>
<tr>
<th>Southern Corn Leaf Blight</th>
<th>Grey Leaf Spot</th>
<th>Common Rust</th>
<th>Phaeo-podia Leaf Spot **</th>
<th>Diplodia Cob Rot</th>
<th>Cab and Tassel Smut</th>
<th>Herbicide Sensitivity</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Trait</th>
<th>Sulfonylurea</th>
<th>2</th>
<th>2</th>
<th>2</th>
<th>2</th>
<th>2</th>
</tr>
</thead>
</table>

#### YIELD DRYLAND

- **Relative number of days to 50% tassel**
- **Relative number of HU to 50% tassel**
- **Relative number of days to physiological maturity**
- **Approximate days to harvest (<15% moisture)**

#### General Characteristics

- **Drying Rate**
- **Tillering**
- **Prolificacy**
- **Standability**

#### Disease Risk**

<table>
<thead>
<tr>
<th>Northern Corn Leaf Blight</th>
<th>Grey Leaf Spot</th>
<th>Common Rust</th>
<th>Phaeo-podia Leaf Spot **</th>
<th>Diplodia Cob Rot</th>
<th>Cab and Tassel Smut</th>
<th>Herbicide Sensitivity</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Trait</th>
<th>Sulfonylurea</th>
<th>2</th>
<th>2</th>
<th>2</th>
<th>2</th>
<th>2</th>
</tr>
</thead>
</table>

#### Sulfonylurea

- **Max. Temp (ºC) + Min. Temp (ºC)**
- **Daily Heat Units**

**NB:** Is influenced by planting date and the daily HU during the growing season. **Heat Units determined from emergence to flowering (Max ≤30ºC and Min ≥10ºC).** **Ratings are not absolute, environmental conditions play the greatest role.*** These diseases do not necessarily affect the yield in a significant manner. **Note:** Where a history of pre-germination occurs, a molybdenum foliar spray is recommended.

The above information is based on long-term results of PANNAR cultivars. It is given in good faith. PANNAR does not warrant or guarantee the performance of the varieties and the seed in any manner whatsoever nor does PANNAR warrant the size or quality of the yield of the seed supplied to the farmer.
The PANNAR maize package comprises an excellent range of medium early and medium hybrids, for a formidable package. The hybrids offer outstanding performance and stability across all western dryland production regions.

NB! The management of possible insect resistance to the Bt gene is legally binding. The planting of a refuge according to regulations is required where any Bt hybrids are used (B or BR). Refer to schematic guidelines on page 30.

The western production region includes the North West, the Western Free State and Limpopo.

Good risk distribution in the western region is achieved by management of the planting date and good moisture conservation practices. An important requirement for hybrids in this region is high prolificacy, in order to maximise production when optimal conditions occur and minimise risk under sub-optimal conditions.

NOTES
REGIONAL RECOMMENDATIONS AND HYBRID PACKAGE COMPOSITION

The regional recommendations are based on PANNAR’s perennial trial results. The graphs and tables summarise the growth classes and hybrids recommended per region. This information can be used in conjunction with the regional map, agronomic characteristics and plant population recommendations to select the best hybrid combinations. Please consult your regional sales representative for the most accurate selection for your specific requirements.

North West (Region 4)

- **White Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Ultra Early: PAN 3A-173, PAN 3R-573R
    - Early: PAN 4A-111, PAN 4R-511R, PAN 4R-711BR
    - Medium Early: PAN 5A-291, PAN 5B-491B, PAN 5R-591R, PAN 5R-791BR, PAN 5R-891BR, BG 5285, BG 5685R, PAN 5R-785BR

- **Yellow Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Early: PAN 4R-672R, PAN 4R-7288BR
    - Medium Early: PAN 5A-182, PAN 5A-190, PAN 5R-590R, PAN 5R-554R
    - Medium: PAN 4R-680R, PAN 4R-7108BR

North Western Free State (Region 5)

- **White Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Medium Early: PAN 5A-291, PAN 5B-491B, PAN 5R-591R, PAN 5R-791BR, PAN 5R-891BR, BG 5285, PAN 5B-485B, PAN 5R-785BR

- **Yellow Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Medium Early: PAN 5A-291, PAN 5B-491B, PAN 5R-591R, PAN 5R-791BR, PAN 5R-891BR, BG 5285, PAN 5B-485B, PAN 5R-785BR

North Eastern Free State (Region 6)

- **White Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Ultra Early: PAN 3A-173, PAN 3R-573R
    - Early: PAN 4A-111, PAN 4R-511R, PAN 4R-711BR
    - Medium Early: PAN 5R-591R, PAN 5R-791BR, PAN 5R-891BR, BG 5285, PAN 5B-485B, PAN 5R-785BR

- **Yellow Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Ultra Early: PAN 3A-173, PAN 3R-573R
    - Early: PAN 4A-111, PAN 4R-511R, PAN 4R-711BR
    - Medium Early: PAN 5A-291, PAN 5B-491B, PAN 5R-591R, PAN 5R-791BR, PAN 5R-891BR, BG 5285, PAN 5B-485B, PAN 5R-785BR

Far North West and Limpopo (Region 7)

- **White Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Ultra Early: PAN 3R-573R
    - Medium Early: PAN 5A-291, PAN 5B-491B, PAN 5R-591R, PAN 5R-791BR, PAN 5R-891BR, BG 5285, BG 5685R, PAN 5R-785BR

- **Yellow Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Early: PAN 4R-672R
    - Medium Early: PAN 5A-182, PAN 5A-190, PAN 5R-590R, PAN 5R-554R
    - Medium: PAN 4R-680R, PAN 4R-7108BR

South Western Free State (Region 7)

- **White Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Ultra Early: PAN 3A-173, PAN 3R-573R
    - Medium Early: PAN 5A-291, PAN 5B-491B, PAN 5R-591R, PAN 5R-791BR, PAN 5R-891BR, BG 5285, PAN 5B-485B, PAN 5R-785BR

- **Yellow Hybrid Package**
  - **Growth Class**
  - **Hybrid**
    - Early: PAN 4A-172, PAN 4R-672R, PAN 4R-7288BR
    - Medium Early: PAN 5A-182, PAN 5A-190, PAN 5R-590R, PAN 5R-554R
    - Medium: PAN 4R-680R, PAN 4R-7108BR
WHITE HYBRID PACKAGE – DRYLAND WESTERN REGION

The PANNAR white hybrid package is distinguished by its exceptional performance and stability. The white package has exciting new top performers added for the coming season. In the dryland western regions PAN SR-791BR, PAN SR-891BR (MON89034) and PAN SR-785BR (MON89034) platforms are the core of the PANNAR white hybrid package.

<table>
<thead>
<tr>
<th>Growth Class</th>
<th>Hybrid</th>
<th>Plant Population per ha (’000s)</th>
<th>North Western Free State</th>
<th>North Eastern Free State</th>
<th>North West</th>
<th>Low Rainfall **</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PAN 3R-573R</td>
<td>–</td>
<td>–</td>
<td>15 – 25</td>
<td>25 – 36</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>PAN 4B-311B</td>
<td>–</td>
<td>–</td>
<td>20 – 25</td>
<td>25 – 36</td>
<td>–</td>
</tr>
<tr>
<td>Medium Early</td>
<td>BG 5285</td>
<td>18 – 22</td>
<td>20 – 36</td>
<td>15 – 22</td>
<td>20 – 36</td>
<td>16 – 20</td>
</tr>
<tr>
<td></td>
<td>BG 5685R</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PAN 5B-485B</td>
<td>20 – 25</td>
<td>20 – 36</td>
<td>15 – 22</td>
<td>20 – 36</td>
<td>16 – 20</td>
</tr>
<tr>
<td></td>
<td>PAN 5R-785BR</td>
<td>20 – 25</td>
<td>20 – 36</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Medium</td>
<td>PAN 6R-579R</td>
<td>–</td>
<td>18 – 24</td>
<td>18 – 24</td>
<td></td>
<td>16 – 20</td>
</tr>
<tr>
<td></td>
<td>PAN 6R-679BR</td>
<td>–</td>
<td>18 – 24</td>
<td>18 – 24</td>
<td></td>
<td>16 – 20</td>
</tr>
<tr>
<td></td>
<td>PAN 6Q-865BR</td>
<td></td>
<td>18 – 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Main planting, highly recommended**  ■ Strategic hybrid, supplementary planting  *Potential, **Far North West, South Western Free State and Limpopo

### WHITE HYBRIDS AGRONOMIC CHARACTERISTICS - WESTERN DRYLAND

<table>
<thead>
<tr>
<th>Growing Season Class</th>
<th>Ultra Early</th>
<th>Early</th>
<th>Medium Early</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative number of days to 50% tassel</td>
<td>Warmer Areas</td>
<td>56</td>
<td>58</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Cooler Areas</td>
<td>76</td>
<td>79</td>
<td>80</td>
</tr>
<tr>
<td>Relative number of HU to 50% tassel</td>
<td>Warmer Areas</td>
<td>670</td>
<td>708</td>
<td>715</td>
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<td></td>
<td>Cooler Areas</td>
<td>84</td>
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<tr>
<td>Relative number of days to physiological maturity</td>
<td>Warmer Areas</td>
<td>105</td>
<td>115</td>
<td>116</td>
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<tr>
<td></td>
<td>Cooler Areas</td>
<td>145</td>
<td>148</td>
<td>150</td>
</tr>
<tr>
<td>Approximate days to harvest (&lt;15% moisture) (Influenced by prevailing humidity)</td>
<td>Warmer Areas</td>
<td>165</td>
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<td>165</td>
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<tr>
<td></td>
<td>Cooler Areas</td>
<td>180</td>
<td>210</td>
<td>200</td>
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</table>

### Yield Dryland

<table>
<thead>
<tr>
<th>(4) North Western Free State</th>
<th>(5) North West</th>
<th>(6) North Eastern Free State</th>
<th>(7) Far North West, South Western Free State and Limpopo</th>
</tr>
</thead>
</table>

### General Characteristics

<table>
<thead>
<tr>
<th>Drying Rate</th>
<th>Tilling</th>
<th>Prolificacy</th>
<th>Standability</th>
<th>Disease Risk**</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Northern Corn Leaf Blight</td>
</tr>
<tr>
<td></td>
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<td>Sulfonylurea</td>
</tr>
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### Herbicide Sensitivity

<table>
<thead>
<tr>
<th>Sulfonylurea</th>
<th>Good</th>
<th>Average</th>
<th>Poor</th>
</tr>
</thead>
</table>

16
**YELLOW HYBRID PACKAGE – DRYLAND WESTERN REGION**

The medium early and medium class hybrids are a formidable package and are also particularly suitable as maize foggage or silage.

### Growth Class

<table>
<thead>
<tr>
<th>Growth Class</th>
<th>Hybrid</th>
<th>Plant Population per ha ('000s)</th>
<th>North Western Free State</th>
<th>North Eastern Free State</th>
<th>North West</th>
<th>Low Rainfall**</th>
</tr>
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<tbody>
<tr>
<td><strong>Ultra Early</strong></td>
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<td></td>
</tr>
<tr>
<td>BG 3292</td>
<td>–</td>
<td>25 – 40</td>
<td>–</td>
<td>25 – 40</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BG 3492B</td>
<td>–</td>
<td>25 – 40</td>
<td>–</td>
<td>25 – 40</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BG 3592R</td>
<td>–</td>
<td>25 – 40</td>
<td>–</td>
<td>25 – 40</td>
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<tr>
<td>BG 3792BR</td>
<td>–</td>
<td>25 – 40</td>
<td>–</td>
<td>25 – 40</td>
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<td>–</td>
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<tr>
<td>PAN 3R-386R</td>
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<td>PAN 3R-7866R</td>
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</tr>
<tr>
<td>PAN 3R-500R</td>
<td>–</td>
<td>25 – 40</td>
<td>–</td>
<td>25 – 40</td>
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</tr>
<tr>
<td>PAN 3R-500R</td>
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<td>25 – 40</td>
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<td>25 – 40</td>
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</tr>
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<td><strong>Early</strong></td>
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<td>18 – 24</td>
<td>15 – 22</td>
<td>18 – 24</td>
<td>16 – 20</td>
<td>18 – 22</td>
</tr>
<tr>
<td>PAN 5R-500R</td>
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<td>18 – 24</td>
<td>15 – 22</td>
<td>18 – 24</td>
<td>16 – 20</td>
<td>18 – 22</td>
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<tr>
<td>PAN 5R-500R</td>
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<td>18 – 24</td>
<td>15 – 22</td>
<td>18 – 24</td>
<td>16 – 20</td>
<td>18 – 22</td>
</tr>
<tr>
<td><strong>Medium Early</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>PAN 6B-410B</td>
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<td>15 – 22</td>
<td>18 – 24</td>
<td>16 – 20</td>
<td>18 – 22</td>
</tr>
<tr>
<td><strong>Medium</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>PAN 7A-100</td>
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<td>15 – 22</td>
<td>18 – 24</td>
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<tr>
<td>PAN 7R-500R</td>
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<td>18 – 24</td>
<td>15 – 22</td>
<td>18 – 24</td>
<td>16 – 20</td>
<td>18 – 22</td>
</tr>
</tbody>
</table>

- **Main planting, highly recommended**
- **Strategic hybrid, supplementary planting**

**NB:** HU = Heat Units.

- HU = Heat Units. **NB:** Is influenced by planting date and the daily HU during the growing season. *Heat Units determined from emergence to flowering (Max ≤30°C and Min ≥10°C). **Ratings are not absolute, environmental conditions play the greatest role. *** These diseases do not necessarily affect the yield in a significant manner.

The above information is based on long-term results of PANNAR cultivars. It is given in good faith. PANNAR does not warrant or guarantee the performance of the varieties and the seed in any manner whatsoever nor does PANNAR warrant the size or quality of the yield of the seed supplied to the farmer.
THE BEST UNDER IRRIGATION

PANNAR’s ultra early yellow hybrid package is an industry leader. PANNAR’s irrigation package comprises conventional, stalk borer resistant, glyphosate herbicide tolerant and stacked gene hybrids. Hybrid choice is very important, with the emphasis on stability. The package can be utilised in a single or double cropping system, where, for example, maize follows wheat cultivation. The ultra early growth class hybrids are the obvious choice in a wheat-maize rotation system.

The ultra early hybrids typically have a single-stem, upright growth habit, tend to be single cobbing and have excellent standability. The foundation for a high potential grain yield is accurate planting: spacing plants uniformly within the row and planting at the same depth. Uniform seedling emergence creates the opportunity for optimal production per plant. The ultra early hybrids are recommended at a high plant population and it is therefore advisable to reduce planting speed to ensure the best possible intra-row plant spacing (approximately six kilometres per hour is ideal).

If cultivation takes place under less intensive management conditions, the longer season hybrids may be considered for planting under irrigation. Yield results in excess of 12 tonnes per hectare are realistic for these types of hybrids if planted early.
The ultra early hybrids provide top yield results when best management practices are applied. The ultra early package has been reinforced with three new exceptional genetic platforms, PAN 3R-724BR, PAN 3R-786BR and PAN 3R-700BR, offering a substantial yield increase. These new genetic platforms have already established an excellent performance record under irrigation. Please consult your agronomist or sales representative for best placement.

## Growth Class Hybrid

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Eastern Highveld and KwaZulu-Natal</th>
<th>Warm Western Highveld, Limpopo and Eastern Cape</th>
<th>Northern Cape</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG 3292</td>
<td>80 – 100</td>
<td>80 – 100</td>
<td>80 – 100</td>
</tr>
<tr>
<td>BG 3492B</td>
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</tr>
<tr>
<td>BG 3592R</td>
<td>80 – 100</td>
<td>80 – 100</td>
<td>80 – 100</td>
</tr>
<tr>
<td>BG 3792BR</td>
<td>80 – 100</td>
<td>80 – 100</td>
<td>80 – 100</td>
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<td>PAN 3A-124</td>
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<tr>
<td>PAN 3R-524R</td>
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<td>PAN 3R-724BR</td>
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<td>PAN 3R-586R</td>
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</tr>
<tr>
<td>PAN 3R-786BR</td>
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<td>80 – 100</td>
</tr>
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<td>PAN 3R-500R</td>
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<td>PAN 3R-700BR</td>
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<td>PAN 4A-156</td>
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<td>PAN 4A-172</td>
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<td>PAN 4R-672R</td>
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<td>PAN 4R-772BR</td>
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<td>PAN 5R-590R</td>
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<td>PAN 5R-790BR</td>
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<td>PAN 6B-410B</td>
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<td>PAN 6R-710BR</td>
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<tr>
<td>PAN 6R-680R</td>
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</table>

### Yield Irrigation
- Eastern Free State, Mpumalanga and KwaZulu-Natal
- Western Free State, North West, Limpopo and Eastern Cape
- Northern Cape

### General Characteristics
- Drying Rate
- Tilling
- Prolificacy
- Standability

### Disease Risk
- Northern Corn Leaf Blight
- Grey Leaf Spot
- Common Rust
- Phaeosphaeria Leaf Spot
- Diplodia Cob Rot
- Cob and Tassel Smut

### Herbicide Sensitivity
- Sulfuronilurea

### Sulfonylurea

<table>
<thead>
<tr>
<th>Yield Potential</th>
<th>Standability and Prolificacy</th>
<th>Tilling and Disease Risk</th>
<th>Herbicide Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Good</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Average</td>
<td>Average</td>
<td>Average</td>
<td>Average</td>
</tr>
<tr>
<td>Poor</td>
<td>Poor</td>
<td>High</td>
<td>High</td>
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</tbody>
</table>

### Relative Number of Days to 50% Tassel

<table>
<thead>
<tr>
<th>Season Class</th>
<th>Warmer Areas</th>
<th>Cool Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra Early</td>
<td>54 53</td>
<td>76 75</td>
</tr>
<tr>
<td>Early</td>
<td>56 60</td>
<td>78 79</td>
</tr>
<tr>
<td>Medium Early</td>
<td>63 61</td>
<td>80 81</td>
</tr>
<tr>
<td>Medium</td>
<td>65 63</td>
<td>82 81</td>
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</table>

### Relative Number of HU to 50% Tassel

<table>
<thead>
<tr>
<th>Season Class</th>
<th>Warmer Areas</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ultra Early</td>
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<td>768 750</td>
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<tr>
<td>Early</td>
<td>690 710</td>
<td>720 710</td>
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<td>Medium Early</td>
<td>725 735</td>
<td>775 775</td>
</tr>
<tr>
<td>Medium</td>
<td>735 735</td>
<td>780 780</td>
</tr>
</tbody>
</table>

### Approximate Days to Harvest (~15% moisture) (Influenced by prevailing humidity)

<table>
<thead>
<tr>
<th>Season Class</th>
<th>Warmer Areas</th>
<th>Cool Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra Early</td>
<td>165 163</td>
<td>160 165</td>
</tr>
<tr>
<td>Early</td>
<td>165 165</td>
<td>165 165</td>
</tr>
<tr>
<td>Medium Early</td>
<td>170 173</td>
<td>175 180</td>
</tr>
<tr>
<td>Medium</td>
<td>180 180</td>
<td>180 180</td>
</tr>
</tbody>
</table>

### Relative Number of Days to Physiological Maturity

<table>
<thead>
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<th>Warmer Areas</th>
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</tr>
</thead>
<tbody>
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<td>145 143</td>
</tr>
<tr>
<td>Early</td>
<td>105 145</td>
<td>150 155</td>
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<tr>
<td>Medium Early</td>
<td>115 120</td>
<td>155 160</td>
</tr>
<tr>
<td>Medium</td>
<td>120 126</td>
<td>165 165</td>
</tr>
</tbody>
</table>

### Approximate Days to Harvest (~15% moisture) (Influenced by prevailing humidity)

<table>
<thead>
<tr>
<th>Season Class</th>
<th>Warmer Areas</th>
<th>Cool Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra Early</td>
<td>165 163</td>
<td>160 165</td>
</tr>
<tr>
<td>Early</td>
<td>165 165</td>
<td>165 165</td>
</tr>
<tr>
<td>Medium Early</td>
<td>170 173</td>
<td>175 180</td>
</tr>
<tr>
<td>Medium</td>
<td>180 180</td>
<td>180 180</td>
</tr>
</tbody>
</table>
The white package has exciting new top performing ultra early white hybrids added for the coming season. These include PAN 3A-173 and PAN 3R-573R that exhibit a typical ultra early plant-type and characteristics with an upright leaf growth habit ideal for high population high input irrigation conditions. The white package also includes South Africa’s most popular green mealie, SC 701.

<table>
<thead>
<tr>
<th>Growth Class</th>
<th>Hybrid</th>
<th>Plant Population per ha (‘000s)</th>
<th>Eastern Highveld and KwaZulu-Natal</th>
<th>Warm Western Highveld, Limpopo and Eastern Cape</th>
<th>Northern Cape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra Early</td>
<td>PAN 3A-173</td>
<td>80</td>
<td>80</td>
<td>80 – 100</td>
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<tr>
<td></td>
<td>PAN 3R-573R</td>
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<tr>
<td>Early</td>
<td>PAN 4A-111</td>
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<td>65</td>
<td>55 – 65</td>
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<tr>
<td></td>
<td>PAN 4B-311B</td>
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<td></td>
<td>PAN 4R-511R</td>
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<td></td>
<td>PAN 4R-711BR</td>
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<tr>
<td>Medium Early</td>
<td>BG 5285</td>
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<td></td>
<td>BG 5685R</td>
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<td>PAN SR-785BR</td>
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<td>Medium</td>
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<td></td>
<td>PAN SB-491B</td>
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<td>PAN SR-791BR</td>
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<td>PAN 3R-891BR</td>
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<tr>
<td>Medium</td>
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<td>45 – 50</td>
<td>25 – 35</td>
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<td></td>
<td>PAN 6Q-865BR</td>
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<tr>
<td>Green Mealie</td>
<td>SC 701</td>
<td>25</td>
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</table>

<table>
<thead>
<tr>
<th>Growing Season Class</th>
<th>Ultra Early</th>
<th>Early</th>
<th>Medium Early</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Warmer Areas</td>
<td></td>
<td>Cooler Areas</td>
<td></td>
</tr>
<tr>
<td>*Relative number of days to 50% tassel</td>
<td>56</td>
<td>58</td>
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</tr>
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<td>*Relative number of HU to 50% tassel</td>
<td>670</td>
<td>708</td>
<td>715</td>
<td>715</td>
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<tr>
<td>*Relative number of days to physiological maturity</td>
<td>105</td>
<td>115</td>
<td>116</td>
<td>116</td>
</tr>
<tr>
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<td>76</td>
<td>79</td>
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</tr>
<tr>
<td>Warmer Areas</td>
<td>145</td>
<td>148</td>
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<tr>
<td>Cooler Areas</td>
<td>165</td>
<td>170</td>
<td>165</td>
<td>165</td>
</tr>
<tr>
<td>Warmer Areas</td>
<td>180</td>
<td>210</td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>

**Yield Irrigation**
- Eastern Free State, Mpumalanga and KwaZulu-Natal
- Western Free State, North West, Limpopo and Eastern Cape
- Northern Cape

**General Characteristics**
- Drying Rate
- Tillering
- Prolificacy
- Standability

**Disease Risk**
- Northern Corn Leaf Blight
- Grey Leaf Spot
- Common Rust
- Phaeosphaeria Leaf Spot
- Diplodia Cob Rot
- Cob and Tassel Smut

**Herbicide Sensitivity**
- Sulfonylurea

HU = Heat Units  *NB: A influence by planting date and the daily HU during the growing season. *Heat Units determined from emergence to flowering (Max 30°C and Min ≥10°C) **Ratings are not absolute, environmental conditions play the greatest role. *** These diseases do not necessarily affect the yield in a significant manner. Note: Where a history of pre-germination occurs, a molybdenum foliar spray is recommended.

The above information is based on long-term results of PANNAR cultivars. It is given in good faith. PANNAR does not warrant or guarantee the performance of the varieties and the seed in any manner whatsoever nor does PANNAR warrant the size or quality of the yield of the seed supplied to the farmer.
SUCCESS UNDER IRRIGATION

The climate and environment greatly influence the development and yield of maize. With production under irrigation, we can manipulate some of the environmental and managerial variables to optimise production. This information is provided to emphasise the critical production practices, including efficiency and timing, needed for optimum growth to achieve higher yields and profits.

CULTIVATION

An even soil surface is an advantage.
Excessive runoff can be a problem and is often due to a compaction layer.
If the soils are prone to runoff, perform a “wet-rip” before the V5 growth stage.
It increases water infiltration and aeration - irrigate soon afterwards, as plants can rapidly go into moisture stress.

PLANT AND PLANT POPULATION

The goal is uniform germination to minimise inter-plant competition. This is determined by the proper and efficient functioning of your planter. Ensure that it is set up and calibrated correctly before planting and monitor performance regularly throughout the planting process.

The goal of planting is to obtain uniformity:
- Even soil seedbed, plant spacing, planting depth, soil contact, fertiliser placement and irrigation. Good contact between the seed, soil and moisture is a function of the planting depth and pressure wheel setting.
- Optimal germination will take place above 15°C.
- Formation of a crust and clods are unfavourable.
- Good weed control is critically important in the plant’s early development stages.

Intra-row spacing: 13-15 cm (not less than 12 cm between plants).
Plant population: 80 000-90 000/ha for ultra early hybrids.
Planting depth: 5-8 cm.
Planter: Plant slowly, ±5.5 km/hour to ensure uniformity.

FERTILISATION

General:
- Check application regularly.
- Fertigation is effective.
- Avoid nutrient deficiencies at all times.
- Beware of a high salt index and fertiliser burn when band placing.
- Band placement improves early vigour.

Nitrogen:
- For high yields, 280-350 kg N/ha is recommended.
- Apply ±20% at planting.

If application can be done through the irrigation system, the balance of the nitrogen can be applied as six top dressings depending on the soil type. The amount can be gradually increased as plants become more mature.

Recommended top dressing timings:
- After emergence, at about the three leaf stage.
- Five to six leaf stage.
- Ten to twelve leaf stage.
- Eighteen leaf stage.
- Tassel emergence.
- Just after flowering (Max 25 kg N/ha).

“IT’S THE LITTLE THINGS THAT MAKE THE BIG THINGS POSSIBLE. ONLY CLOSE ATTENTION TO THE FINE DETAILS OF ANY OPERATION MAKES THE OPERATION FIRST CLASS.” ~John Willard Marriott

WATER SCHEDULING

Uniform Application:
- Check uniformity and physical delivery of the sprinkler package.
- Sprinkler lifetime is limited and should be checked at least every five years. Make sure the sprinkler package can supply enough water in the critical times.
- The most critical time is one week before pollination up to and completion of grain filling. Apply water at the right time and right amount per growth stage.
- Water application is a function of soil type, climate and root development.
- Check uniform wetting of the field.
- Irrigate until 80% of the husk leaves have turned brown.

Corrective management practices may be necessary under the following circumstances:
- Heavy rainfall after planting and before emergence.
- Large variation between day and night temperatures.
- Low night temperatures.
- Strong winds.
- Crusting.
- Leaching of fertiliser.

Apply quality control regularly without exception.
The PANNAR white hybrid package is characterised by good performance, adaptability and stability across the different production regions with good risk management. The white package has exciting new top performers added for the coming season. In the dryland eastern region the PAN 3A-173 and PAN 4A-111 platforms form the backbone of the PANNAR package. In the western regions PAN 5R-791BR, PAN 5R-891BR (MON89034) and PAN 5R-785BR (MON89034) platforms are the core of the PANNAR white hybrid package. Under irrigation the PAN 3A-173 platform is the first choice.

Ultra Early Package:

PAN 3A-173 and PAN 3R-573R (NEW):

Dryland: These hybrids are well adapted to the high potential eastern production areas (Mpumalanga, eastern Free State and KwaZulu-Natal) at high plant populations of 45 000 to 60 000 plants per hectare.

High input irrigation (high yield; requires high management input including optimal water application): This irrigation hybrid platform is on par with the yellow ultra early hybrids and fits in well with a double-cropping production system. They are recommended for all production regions under irrigation at high plant populations of 80 000 to 100 000 plants per hectare.

These hybrids exhibit a typical ultra early plant-type and characteristics with an upright leaf growth habit, they tend not to tiller and have good standability. Under dryland conditions, these hybrids may be prolific. These hybrids produce a high ratio of grain to stover. They are well adapted to high plant populations with good general disease tolerance and good grain quality. In areas where high levels of Northern Corn Leaf Blight are encountered, the YIELDBOOST® fungicide spray programme is recommended to curb the disease and protect the yield potential (see the guidelines for fungicide spraying programme on page 33).

Early Package:

PAN 4A-111, PAN 4R-511R, PAN 4B-311B and PAN 4R-711BR:

Dryland: This package is an excellent choice for all the eastern production areas including the north eastern Free State. It delivers excellent performance in the mist belt areas. This early white hybrid package is PANNAR's most popular series in the eastern production region, which is underwritten by its excellent performance in the ARC national trials.

Irrigation: These hybrids are well suited in a single cropping system under irrigation or supplementary irrigation.

The platform is characterised by good general disease tolerance, standability, hectolitre mass, grain and milling quality. Where leaf diseases are normally anticipated, the YIELDBOOST® fungicide spray programme provides effective control and protects the yield potential.

Medium Early Package:

BG 5285 and BG 5685R:

Dryland: These two BIOGENE® hybrids offer good stability and are highly prolific. They are recommended as part of the main planting for all the western production regions (north western Free State and North West). They are also well adapted to all the eastern production regions, including the north eastern Free State. Both hybrids performed well in the ARC trials during the 2017/2018 season.

Irrigation: These hybrids fit in well where only a single crop of maize is grown under irrigation or supplementary irrigation. Both hybrids are a very good choice for silage production in terms of quality as well as quantity. These hybrids have an attractive plant type, are agronomically well-balanced and show good tolerance to Cob and Tassel Smut and Northern Corn Leaf Blight (NCLB).

PAN 5B-485B and PAN 5R-785BR:

Hybrids with the MON89034 stalk borer resistance trait.

Dryland: These hybrids provide second-generation stalk borer protection and are characterised by good stability and prolificacy. They are especially well adapted to the western production regions (north western Free State and North West) and are recommended as part of the main planting. This package is also well adapted to the temperate eastern production regions, including the north eastern Free State. BG 5685R and PAN 5R-591R are recommended as refuge for PAN 5R-785BR. 

Irrigation: These hybrids fit in well where only a single crop of maize is grown under irrigation or supplementary irrigation. These hybrids have an attractive plant type, are agronomically well-balanced and show good tolerance to Cob and Tassel Smut and NCLB.
PAN SA-291, PAN SR-591R and PAN SR-791BR:

**Dryland:** This platform is highly prolific. These hybrids demonstrate strong seedling vigour and are especially well adapted to the western production regions (north western Free State and North West), where they are recommended as the core of the main package. They are well adapted to the eastern production regions, including the north eastern Free State. PAN SR-791BR and PAN SR-591R performed very well throughout the ARC national trials for the western production region during the 2016/17 and 2017/18 seasons.

PAN SB-491B and PAN SR-891BR (NEW):

Hybrids with the MON89034 stalk borer resistance trait.

**Dryland:** These hybrids come from the same genetic background as PAN SR-791BR and are highly prolific with the added advantage of second-generation stalk borer protection. They are well adapted to all production areas, especially the western production regions of the north western Free State and North West. They are strongly recommended to make up the core of a hybrid package, particularly in the west. The package is well adapted to the eastern production regions, including the north eastern Free State.

**Medium Package:**

PAN 6R-779BR (NEW):

**Dryland:** This hybrid is well suited to the western production region and is particularly well adapted to the water table soils of the north western Free State. Late plantings in the cooler eastern parts should be avoided as it matures later.

**Irrigation:** This hybrid can be planted where only a single crop of maize is grown under irrigation or supplementary irrigation. The recommended plant population should not exceed 55 000 plants per hectare.

This hybrid has upright leaves with excellent standability. Exhibits good tolerance to NCLB.

PAN 6Q-865BR:

A hybrid with the MON89034 stalk borer resistance trait.

**Dryland:** PAN 6Q-865BR is well adapted to all the maize production areas with the advantage of second-generation stalk borer tolerance. It is well suited to dryland production. Late plantings in the cooler eastern parts should be avoided.

**Irrigation:** This hybrid can be planted where only a single crop of maize is grown under irrigation or supplementary irrigation. The recommended plant population should not exceed 55 000 plants per hectare.

The genetic background of this hybrid provides good tolerance to Diplodia Ear Rot, Grey Leaf Spot (GLS) and Cob and Tassel Smut. It exhibits good standability and reasonably good aluminium tolerance. Can be prone to tillers in certain seasons or environments. A good choice for silage production.

**Green Mealie:**

SC 701:

**Irrigation:** With its large cob, big tasty kernels and exceptional shelf life, SC 701 is the undisputed leader in the green and roasting mealie industry in South Africa. This is the hybrid of choice for green mealie farmers, traders and hawkers. It is also suitable for producing baby corn. As it falls in the medium late growth class, SC 701 dries down slowly. It is also an excellent silage cultivar.

SC 701, which has good tolerance to Maize Streak Virus, is recommended at a population between 25 000 and 35 000 plants per hectare. A population of 25 000 plants per hectare in the high season from December to February, when green mealies are readily available, will ensure the bigger marketable cobs preferred by street vendors (hawkers) are available. Farmers are advised to take preventative measures against GLS.
YELLOW HYBRID PACKAGE

This formidable yellow maize package of ultra early, early and medium hybrids offers excellent options for dryland or irrigated production. The ultra early package has been reinforced with three new exceptional genetic platforms, i.e. PAN 3R-724BR, PAN 3R-786BR and PAN 3R-700BR, offering a substantial yield increase. These new genetic platforms have already established an excellent performance record under irrigation and in the high potential dryland production regions.

Ultra Early Package:
BG 3292, BG 3492B, BG 3592R and BG 3792BR:
High input irrigation (high yield; requires high management input including water application): This complete platform of BIOGENE® hybrids has performed very well under commercial conditions and in PANNAR’s multi-season irrigation trials over the past six years. They display good stability and are recommended for all production areas.

Dryland:
The group of hybrids is well adapted to the eastern Highveld (Mpumalanga and eastern Free State) and KwaZulu-Natal. They are recommended as part of the main planting and are well adapted to the high potential soils of the north western and north eastern Free State. The recommended plant population is at least 20-30% higher than that for typical medium growth class hybrids under dryland conditions.

These hybrids usually produce very few tillers and have very good standability and grain quality. They are agronomically well-balanced and show good tolerance to Rust and Diplodia Ear Rot. Where the ultra early hybrids are grown in the eastern Highveld and KwaZulu-Natal and leaf diseases are normally anticipated, the YIELDBOOST® fungicide spray programme is recommended to protect the yield potential (see the guidelines for fungicide spraying programme on page 33).

PAN 3A-124, PAN 3R-524R and PAN 3R-724BR (NEW):
High input irrigation: Excellent hybrids under irrigation. Achieved first place in the PANNAR irrigation evaluation trials for the past two seasons – outcompeting the runner-up by a significant margin. The plant type lends itself to high plant populations from 95 000 to 100 000 plants per hectare. These hybrids distinguish themselves with good yield and stability in all production areas. PAN 3A-124 is intended to replace PAN 6126.

Dryland: A good choice for the high potential regions of the eastern Highveld and KwaZulu-Natal. The plant type of these hybrids lends itself to high plant populations of 45 000 to 60 000 plants per hectare under dryland production conditions.

Typical ultra early hybrids with an upright leaf growth habit that can be planted at higher plant populations. They tend to produce a fixed ear that is advantageous under high potential conditions that require high plant populations. This platform is the quickest in the PANNAR ultra early range and produces an attractive grain type that dries down rapidly. Even in high plant population conditions, standability is excellent. Where leaf diseases usually occur, the YIELDBOOST® fungicide spray programme is recommended to protect the yield potential.

PAN 3R-586R and PAN 3R-786BR (NEW):
High input irrigation: Exciting new additions to the irrigation package, thoroughly trialled over many seasons – have proved bulletproof. Plant these hybrids with confidence to add stability to your package. They rapidly progress to tasselling and physiological maturation.

Dryland: These hybrids perform well in the high potential areas such as the eastern Highveld regions (Mpumalanga and eastern Free State) and especially KwaZulu-Natal. With features like strong seedling vigour, good tolerance against leaf disease and good standability, these ultra early hybrids are a sure choice. Plant at least 20-30% higher plant population than the medium group of hybrids (≥45 000 plants per hectare). They are almost as quick as the previous package and show good tolerance against leaf diseases, especially Phaeosphaeria and GLS. They tolerate heat stress well, a good attribute for the warm Northern Cape.

PAN 3R-500R and PAN 3R-700BR (NEW):
High input irrigation: Very well adapted in all production areas under irrigation at plant populations of 80 000 to 100 000 plants per hectare. Maintains excellent performance and stability in PANNAR trials under irrigation. They are intended to...
supplement and replace PAN 3Q-740BR and PAN 3P-502R. This platform delivers high volume and quality silage.

**Dryland:** Well adapted to the eastern production areas, they perform well under dryland and should be planted at 20-30% higher plant populations than normally planted in these areas. Attractive plant type with good standability and ear placement. It produces good quality semi-flint grain. These hybrids show good tolerance to NCLB. However, where leaf diseases usually occur, the YIELDBOOST® fungicide spray programme is recommended to protect the yield potential.

**Early Package:**

**PAN 4A-156 (NEW):**

**Dryland:** A new hybrid especially well adapted to KwaZulu-Natal, Mpumalanga and the eastern Free State. With its excellent top-end yield potential, this is a hybrid for your higher potential fields. A higher plant population is recommended as it tends to produce a single ear. Rows on the cobs can range up to 22 rows. This is a good stable mate for PAN 4A-172.

**Irrigation:** It fits in where only a single crop of maize is grown under irrigation or supplementary irrigation. A plant population of not more than 60 000 plants per hectare is recommended. Good overall tolerance against leaf diseases especially Phaeosphaeria.

**PAN 4A-172 and PAN 4R-672R (NEW):**

**Dryland:** These excellent early yellow hybrids are a great choice for the eastern Highveld (Mpumalanga and the eastern Free State). PAN 4A-172 has distinguished itself as the top performer in PANNAR’s hybrid evaluation trials over the past two years and especially in the eastern Free State. These hybrids offer good agronomic balance and tend to carry the ears low on the stalk. Standability is very good. In areas where NCLB is a problem, the YIELDBOOST® fungicide spray programme is recommended to control the disease and protect the yield potential.

**PAN 4R-728BR (NEW):**

**Dryland:** This early growth class hybrid has good tolerance to Brown Rust and excellent top-end yield potential. It is well adapted to the entire eastern production region and should be considered for high potential lands where it will be afforded the opportunity to reach its full potential. This agronomically well balanced hybrid has good standability and will handle higher plant populations very comfortably.

**Irrigation:** It fits in where only a single crop of maize is grown under irrigation or supplementary irrigation. A plant population of up to 70 000 plants per hectare is recommended.

**Medium Early Package:**

**PAN 5A-190 and PAN 5R-590R (NEW):**

**Dryland:** The growing season of this new platform fits in perfectly for the eastern production region. It is well adapted to Mpumalanga and the eastern Free State. The large plant type lends itself to silage production. These hybrids have excellent early vigour, tend to produce a single cob and have good standability. A very healthy plant with good general disease tolerance especially to Diplodia and Brown Rust.

**PAN 5A-154 and PAN 5R-554R (NEW):**

**Dryland:** These are exciting additions to the PANNAR package. In the 2016/17 season these hybrids performed exceptionally in the PANNAR cultivar evaluation programme over a wide range of environmental conditions, which indicates good yield stability and adaptability. They can be prolific at lower plant populations. They maintain their ear size (fixed-ear type) and produce grain with a deep orange colour. A stable mate for PAN 5A-182 and recommended as part of a yellow package to hedge against the environmental risk.

**Irrigation:** These hybrids can be planted with great success where only a single crop is planned under irrigation or supplementary irrigation. These hybrids have good standability and general disease tolerance with good tolerance against Diplodia Cob Rot.

**PAN 5A-182:**

**Dryland and irrigation:** This conventional hybrid produces very good results and is well suited to all production regions. It exhibits exceptionally stable performance and is recommended as the core of every hybrid package, especially in the eastern Highveld (Mpumalanga and eastern Free State). PAN 5A-182 has performed exceptionally well in the ARC trials for the eastern production region over numerous years. It produces excellent quality flinty grain with a golden yellow colour; very popular with merchants. It has excellent general disease tolerance.

**Medium Package:**

The medium class hybrids all perform well in the eastern and western production regions and are also suitable for silage or maize foggage. They are recommended as part of the main planting. It is important to plant this range of medium hybrids at the recommended plant population for their respective production regions.

**PAN 6B-410B and PAN 6R-710BR:**

New hybrids with the MON89034 stalk borer resistance trait.

**Dryland:** These hybrids deliver very good results with the advantage of second-generation stalk borer protection. They show good stability in the eastern and western production regions.

**Irrigation:** These hybrids fit in well where only a single crop of maize is grown under irrigation or supplementary irrigation. Good tolerance to Rust and NCLB. Good standability and drought tolerance. Not sensitive to sulfonylurea herbicides at the recommended dosage.

**PAN 6R-680R:**

**Dryland:** This glyphosate herbicide tolerant hybrid has displayed exceptionally stable performance over various seasons and across the entire eastern and western production regions. It is a good choice where high weed pressures are a concern, as well as for the refuge for PAN 6R-710BR.

**Irrigation:** It fits in well where only a single crop of maize is grown under irrigation or supplementary irrigation. Good tolerance to Cob Rot.

**NB! The management of possible insect resistance to the Bt gene is legally binding. The planting of a refuge as per regulations is required where any Bt hybrids are used (B and BR). Refer to the schematic guidelines on page 30.**
## Maize and Sunflower Seed Spacing Guide

### Row Width (cm) | 45 cm | 76 cm | 91 cm | 120 cm
---|---|---|---|---
### Plant population per ha | Seeds per metre | Distance between Seeds (cm) | Seeds per metre | Distance between Seeds (cm) | Seeds per metre | Distance between Seeds (cm) | Seeds per metre | Distance between Seeds (cm)
90 000 | 4.1 | 24.7 | 6.8 | 14.6 | 8.2 | 12.2 | 10.8 | 9.3
80 000 | 3.6 | 27.8 | 6.1 | 16.4 | 7.3 | 13.7 | 9.6 | 10.4
70 000 | 3.2 | 31.7 | 5.3 | 18.8 | 6.4 | 15.7 | 8.4 | 11.9
60 000 | 2.7 | 37.0 | 4.6 | 21.9 | 5.5 | 18.3 | 7.2 | 13.9
50 000 | 2.3 | 44.4 | 3.8 | 26.3 | 4.6 | 22.0 | 6.0 | 16.7
45 000 | 2.0 | 49.4 | 3.4 | 29.2 | 4.1 | 24.4 | 5.4 | 18.5
40 000 | 1.8 | 55.6 | 3.0 | 32.9 | 3.6 | 27.5 | 4.8 | 20.8
35 000 | 1.6 | 63.5 | 2.7 | 37.6 | 3.2 | 31.4 | 4.2 | 23.8
30 000 | 1.4 | 74.1 | 2.3 | 43.9 | 2.7 | 36.6 | 3.6 | 27.8
27 500 | 1.2 | 80.8 | 2.1 | 47.8 | 2.5 | 40.0 | 3.3 | 30.3
25 000 | 1.1 | 88.9 | 1.9 | 52.6 | 2.3 | 44.0 | 3.0 | 33.3
22 500 | 1.0 | 98.8 | 1.7 | 58.5 | 2.0 | 48.8 | 2.7 | 37.0
20 000 | 1.5 | 65.8 | 1.8 | 54.9 | 2.4 | 41.7
18 000 | 1.4 | 73.1 | 1.6 | 61.1 | 2.2 | 46.3
15 000 | 1.1 | 87.7 | 1.4 | 73.3 | 1.8 | 55.6
12 000 | 1.1 | 91.6 | 1.4 | 69.4
10 000 | 1.2 | 83.3

### Row Width (cm) | 152 cm or 90 x 213 cm | 180 cm | 210 cm | 230 cm
---|---|---|---|---
### Plant population per ha | Seeds per metre | Distance between Seeds (cm) | Seeds per metre | Distance between Seeds (cm) | Seeds per metre | Distance between Seeds (cm) | Seeds per metre | Distance between Seeds (cm)
90 000 | 13.7 | 7.3 | 16.2 | 6.2 | 18.9 | 5.3 | 20.7 | 4.8
80 000 | 12.2 | 8.2 | 14.4 | 6.9 | 16.8 | 6.0 | 18.4 | 5.4
70 000 | 10.6 | 9.4 | 12.6 | 7.9 | 14.7 | 6.8 | 16.1 | 6.2
60 000 | 9.1 | 11.0 | 10.8 | 9.3 | 12.6 | 7.9 | 13.8 | 7.2
50 000 | 7.6 | 13.2 | 9.0 | 11.1 | 10.5 | 9.5 | 11.3 | 8.7
45 000 | 6.8 | 14.6 | 8.1 | 12.3 | 9.5 | 10.6 | 10.4 | 9.7
40 000 | 6.1 | 16.4 | 7.2 | 13.9 | 8.4 | 11.9 | 9.2 | 10.9
35 000 | 5.3 | 18.8 | 6.3 | 15.9 | 7.4 | 13.6 | 8.1 | 12.4
30 000 | 4.6 | 21.9 | 5.4 | 18.5 | 6.3 | 15.9 | 6.9 | 14.5
27 500 | 4.2 | 23.9 | 5.0 | 20.2 | 5.8 | 17.3 | 6.3 | 15.8
25 000 | 3.8 | 26.3 | 4.5 | 22.2 | 5.3 | 19.0 | 5.8 | 17.4
22 500 | 3.4 | 29.2 | 4.1 | 24.7 | 4.7 | 21.2 | 5.2 | 19.3
20 000 | 3.0 | 32.9 | 3.6 | 27.8 | 4.2 | 23.8 | 4.6 | 21.7
18 000 | 2.7 | 36.5 | 3.2 | 30.9 | 3.8 | 26.5 | 4.1 | 24.2
15 000 | 2.3 | 43.9 | 2.7 | 37.0 | 3.2 | 31.7 | 3.5 | 29.0
12 000 | 1.8 | 54.8 | 2.2 | 46.3 | 2.5 | 39.7 | 2.8 | 36.2
10 000 | 1.5 | 65.8 | 1.8 | 55.6 | 2.1 | 47.6 | 2.3 | 43.5
Grain producers may only cultivate hybrids containing any of the Genetically Modified (GM) traits if he/she has signed a valid Technology and Product Stewardship Agreement, thereby accepting the strict conditions and responsibilities regarding the planting and cultivation of the seed. Farmers are required to acquaint themselves with the GMO user guidelines and adhere to the requirements regarding the planting of suitable refuge areas in the case of Bt hybrids and the prescribed herbicide dosage and time of application for glyphosate tolerant hybrids.

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 maize, sweetcorn 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 has 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 marketing 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 maize, sweetcorn, organically produced maize or conventionally produced maize. 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.

**MANAGEMENT OF GENETICALLY MODIFIED MAIZE HYBRIDS**

Insect and weed control are two critical aspects in crop production. Glyphosate tolerance simplifies weed control and the Bt stalk borer resistance gene reduces the impact of stalk borer damage.
GLYPHOSATE TOLERANT HYBRIDS

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 PANNAR® 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 PANNAR® brand sales representative or agronomist.

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 labelled rates 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.

Manage 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 provide the greatest flexibility and success.

The best strategies for managing herbicide tolerant volunteers are crop rotation and rotation of herbicides. The proper adjustment of harvesting equipment, 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 mode-of-action families and/or tillage for the next crop.

Hybrids with glyphosate tolerance offer the following benefits:

- Broad spectrum weed control.
- Excellent crop safety.
- Advantage of conservation cultivating practices.
- Herbicide application flexibility.
- It is easy to manage, has no residual effect in the soil and is environmentally friendly.

PANNAR markets maize hybrids with the glyphosate tolerance gene under licence from Monsanto (maize with the ROUNDUP READY® trait). Only Roundup PowerMAX® (L7769) herbicide is recommended by the registration holder for post-emergence use on maize with the ROUNDUP READY® trait.

Glyphosate herbicide may be applied in combination with certain residual pre-emergence and post-emergence herbicides, independently or as tank mixtures. This provides additional flexibility and better weed control. Please consult your PANNAR or chemical representative for guidelines for the safe and optimal use of the glyphosate tolerant cultivars.

Management Guidelines:

- Broadcast (over the top) glyphosate herbicide application should only take place from the GROUND CRACKING STAGE UP TO THE V8 STAGE of the maize plant. The V8 stage is reached when the first plants in the field have eight leaves, with closed collars around the main stem. The actual number of visible leaves may be more. Do not make broadcast applications if mechanical crop damage will occur due to the passage of the spray rig.
- BROADCAST APPLICATION AFTER THE V8 STAGE MAY RESULT IN YIELD LOSS OR DELAYED MATURITY. For best results, use flat fan or twin jet nozzles that are suitable for low water volume deliveries.
- Where sequential applications are necessary to control specific weed species (e.g. Cyperus esculentus), the second application should not occur within 10 days of the first application. If by this time the maize is beyond the V8 stage, a post directed application (see below) will be necessary.
- Directed glyphosate applications between the rows can be made after the V8 stage where row spacing permits the passage of the application equipment without causing mechanical damage to the maize crop.

Importance of managing herbicide tolerant crops and weed resistance to herbicides

Proper management of herbicide tolerant crop technology is important to preserve the effectiveness and value of the tolerant crop seed and its corresponding herbicides for future use. If you have any questions regarding the stewardship of glyphosate herbicide use and possible weed resistance, please contact your PANNAR sales representative or agronomist.

* ROUNDUP READY® is a registered trademark used under licence from Monsanto Technology LLC.
STALK BORER RESISTANT HYBRIDS

The stalk borer resistance gene in the PANNAR stalk borer resistant hybrids offers protection against first and second instar stalk borers and affords the crop the opportunity to develop to its full potential. The Bt gene will only control small, immature larvae and not adult larvae.

Insect Resistance Management Strategy:

The purpose of the strategy is the protection of the technology, extending its shelf life and ensuring its long-term usability. The insect resistance management strategy comprises the following elements and is legally binding:

■ There are always some individual stalk-borers that are naturally tolerant to the Bt-proteins. Producers must follow an “Insect Resistance Management” programme to ensure that they remain rare in the population.

■ The best way to prevent the tolerant individuals from increasing is to combine effective control with Bt maize in maize fields, with a nearby “refuge” area.

■ A “refuge” is an area where only non-Bt maize is cultivated and where non Bt-based insecticides are used. In this area, maize stalk-borers which are susceptible to the Bt-protein can feed and breed. These susceptible stalk-borers can in turn breed with any of the few naturally tolerant stalk-borer individuals, which survive.

■ If a susceptible stalk-borer breeds with a tolerant one, the offspring are also susceptible. In this way producers can preserve the efficacy of the Bt-technology.

The refuge is also important if farmers encounter problems of any sort with Bt plantings. Continuous monitoring of maize plantings and stalk borer populations is important. Regular inspection will enable farmers to intervene and apply insecticides if it appears that the stalk borer population is not being controlled by the Bt technology.

Options for the refugia:

The farmer can select one of the following options to plant a refuge:

**Option A:** 5% non-Bt maize refuge that may not be treated with an insecticide. In practice, this means that for every 95 hectares of stalk borer resistant maize, the farmer must plant five hectares of non-Bt maize (i.e. maize without any Bt genes). This non-Bt maize may not be treated with any insecticide registered for control of maize stalk borers.

**Option B:** 20% non-Bt maize refuge that may be sprayed (if economic thresholds are met) with a non-Bt protein-containing insecticide/biopesticide. In practice, this means that for every 80 hectares of stalk borer resistant maize, the farmer must plant 20 hectares of non-Bt maize (i.e. maize without any Bt genes). This non-Bt maize can be treated with registered insecticides (if economic thresholds are met), but not with insecticides that contain Bt proteins.

In addition to planting a refuge either to Option A or B, the grower must also adhere to certain important requirements when planting the refuge.

Refuge of non-Bt maize (refer page 30):

■ The non-Bt maize (i.e. refuge) must –
  - have a similar maturity to the Bt maize;
  - be planted within seven days of planting the Bt maize;
  - be planted on the same farm as the Bt maize; and
  - be planted under the same cultivation techniques and growing conditions (e.g. under irrigation) as the Bt maize.

■ Every farmer must plant his/her own maize refuge. In other words, neighbouring farmers’ non-Bt maize lands may not serve as refuge.

■ Refuge “strip” areas must be at least six rows wide with no crossover of Bt and non-Bt rows.

■ Refuge areas must be positioned in such a manner that some refuge is planted on the outside borders of the Bt maize.

■ Mixing of Bt maize seed and non-Bt maize (refuge) seed is not permissible.

■ Refuge maize must be planted in such a manner that no Bt plant is more than 400 m away from a refuge maize plant.

■ Farmers must regularly monitor and inspect their Bt crop and immediately contact their seed representative or agent if stalk borer infestation exceeds the threshold values in the Bt maize.
  - In the case of MON810 the threshold is 10%;
  - In the case of Bt11 it is 5% and
  - In the case of MON89034 please contact your seed representative or agent immediately if any stalk borer infestation is observed.

Compliance with the insect resistance management strategy and particularly with the refuge requirements will be monitored as follows:

■ On-farm compliance monitoring by an independent third party; and

■ General compliance monitoring at individual seed company level during farmer visits.

The representative is required to advise the farmer to ensure on-farm compliance with the refuge planting provisions. It is of the utmost importance that the necessary technology stewardship requirements are observed. In instances where farmers do not comply with these requirements, it will be viewed in a very serious light.

Detailed guidelines for Bt maize production are available from the PANNAR representative.
PLANT THE CORRECT REFUGE AREA FOR BT-MAIZE

STEP 1: Choose the best option for your farm.

**OPTION A:** 5% non-Bt maize refuge that may not be treated with an insecticide.

**OPTION B:** 80% Bt maize refuge that may be sprayed (if economic thresholds are met) with a non-Bt protein containing insecticide/biopesticide.

STEP 2: Depending on the option chosen above, your refuge must be planted in the following manner:

- **Similar hybrid (growth season)**
- **Plant within seven days**
- **May not cross Bt rows**
- **Don’t mix with Bt seed**
- **Strips a minimum of six rows**
- **Plant within 400 m of all Bt plants**
- **Cover outside borders**
- **Plant your own refuge**
- **Same agronomic conditions**

Farmers must regularly monitor and inspect their Bt crop and immediately contact their seed representative or agent if stalk borer infestation exceeds the threshold values in the Bt maize.

- In the case of MON810 the threshold is 10%;
- In the case of Bt11 it is 5%; and
- In the case of MON89034 please contact your seed representative or agent immediately if any stalk borer infestation is observed.
**Correct Layout of the Refuge Area**

**Block Positioning**

- Bt maize
- Refuge maize
- 400 m 400 m

**Strip Positioning**

- Bt maize
- Refuge maize
- 400 m 400 m

**Perimeter Positioning**

- Refuge maize
- Bt maize
- 400 m

**Pivot Positioning**

- Refuge maize
- Bt maize
- 400 m 400 m

**Bordering of Pivot**

- Refuge maize
- Bt maize
- 400 m

**Table: Minimum Number of Rows Required**

<table>
<thead>
<tr>
<th>Pivot Size</th>
<th>Minimum number of rows required per row width in m (5% refuge)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.60 m</td>
</tr>
<tr>
<td>Radius (m)</td>
<td>ha</td>
</tr>
<tr>
<td>178</td>
<td>10</td>
</tr>
<tr>
<td>252</td>
<td>20</td>
</tr>
<tr>
<td>309</td>
<td>30</td>
</tr>
<tr>
<td>357</td>
<td>40</td>
</tr>
<tr>
<td>*399</td>
<td>50</td>
</tr>
<tr>
<td>*437</td>
<td>60</td>
</tr>
<tr>
<td>*472</td>
<td>70</td>
</tr>
<tr>
<td>*505</td>
<td>80</td>
</tr>
<tr>
<td>*535</td>
<td>90</td>
</tr>
<tr>
<td>*564</td>
<td>100</td>
</tr>
<tr>
<td>*592</td>
<td>110</td>
</tr>
<tr>
<td>*618</td>
<td>120</td>
</tr>
</tbody>
</table>

* User must also plant at least six rows in the centre of the pivot, in addition to the rows on the outside.
OUR AGRONOMIC SUPPORT - HOW DO WE ADD VALUE?

OUR AGRONOMY TEAM

PANNAR’s cultivars are developed from leading, diverse sources of genetics and best express their full genetic potential under good management practices. That is why our skilled agronomists are here to help you choose the right seed for your fields.

Their objective, unbiased technical information strives to ensure that your crop performance lives up to your expectations, so use their expertise and service to your advantage. Honest, reliable, involved and knowledgeable, they offer a complete seed line-up and management guidelines to ensure sound crop production and minimise risk whilst protecting the environment and preserving our natural resources.

Trust our agronomists to help you identify environmental risks and devise methods of reducing these risks to boost your efficiency and set you up for success.

OUR AGRONOMIC RESEARCH INITIATIVES

The PANAGRI™ practical farming solutions and the PANACEA™ complete seed and crop protection initiatives.

The PANAGRI research initiative seeks to provide farmers with practical advice on how to optimise all the disciplines that play a key role in progressive crop production, including fertilisation practices, cultivar selection, optimal plant population, crop rotation, tillage and use of agricultural chemicals.

PANACEA® is the label under which PANNAR develops seed treatment programmes for optimal germination, plant population and seedling protection as well as the first class advice for the identification and control of diseases and pests that occur on farmers’ crops from time-to-time. This includes the YIELDBOOST® fungicide and insecticide spray programmes which offer guidelines for the control of such outbreaks (including chemical control of stalk borer on conventional and glyphosate tolerant hybrids).

EXPERT ADVICE AND GUIDANCE

GUIDANCE

- Astute application of knowledge.
- Crop protection: Disease diagnosis, advice and guidance.

SEED TREATMENT

- Precautionary crop protection (seed treatment presentations: fungicide, insecticide and polymers)

YieldBoost

- Fungicide spray programme.
- Insecticide spray programme.

GUIDANCE

- Production management guidelines for every particular area.
- Precision placement of cultivars. Interaction between yield potential, growth class, prolificacy, plant population and cultivar type.

PANNAR® SPROUT™ MOBILE APP

PANNAR developed the PANNAR® SPROUT™ mobile app to put farming at your fingertips. The app has proved a great technical support to farmers in Africa over the last four years since its launch. It continuously evolves in response to our farmers’ needs - there is always something new and useful in the pipeline to simplify your farming operations. It is a must-have for all grain crop farmers.

With this app, you have streamlined access to:

- Our Products
- Crop Disease Gallery
- Find Your Nearest Rep
- Tools
  - Best Hybrid Match
  - Maize Hybrid Comparison
  - Maize Plant Population Recommendation
  - Replant Calculator (maize and soybeans)
  - PlantDr
  - SAFEX prices
  - Yield Estimates Calculator
  - Currency Converter
  - Unit Converter

Farmers can download the PANNAR® Sprout™ free of charge from the Google Play or Apple app stores.

Additional information can be found on www.pannar.com

- Technical Information including Product Production Guides
- Disease Fact Sheets
- Technical articles on our blog
- Company information
OUR AGRONOMIC SUPPORT – HOW DO WE ADD VALUE?

where there may be certain pest risks:

the following products, depending on the hybrid and the area (polymers) are used as seed treatments. The products currently
diseases for a great start. Top quality chemicals and film coatings
seedlings from early-season insects and seed or soil-borne

■ The PANACEA® seed treatment package protects the seed and

SEED TREATMENT

High yields start with a uniform and healthy plant population. The PANACEA® seed treatment package protects the seed and
seedlings from disease in the early stages of plant development.

The effect of fungicides is threefold:

They control fungi and diseases that occur on the seed surface.

They control fungi in the seeds and soil-borne fungi.

Stimulate the development of seedlings and give them a
good boost to success.

■ The addition of a seed treatment may not adversely

affect seed safety, vigour or germination when properly stored.

Stewardship: It is a sustainable solution for customers and a
low-risk for the environment. Producers and consumers should
remember that seed treatments can contain chemicals that must
be handled in a safe manner.

Seed safety: The addition of a seed treatment may not adversely

impact the starting blocks

PANNAR SEED’s goal is to ensure your crop gets off to a great
start, that’s why we place such an emphasis on plantability and
strong seedling growth. PANNAR is committed to identifying
and providing quality seed treatment products and technologies
to improve the efficiency of farming in an environmentally

Before any seed treatment is applied to any crop seed, it must
comply with the following principles:

Plantability: It plants as well or better than the current
products. To ensure a good plant population, seed should flow
easily through the mechanical planter after treatment.

Application: The treatment products are applied correctly
to the seed. During planting, the seed treatment must adhere
to the seed and not come off and remain in the bag or planter bin.
This ensures that the correct dose reaches the target. The use of
film coatings (adhesives) helps to keep the product on the seed,
making it safer for handling and improving the plantability of
the seed.

Regulatory: It is a registered product in the country where the
seed is planted.

SEED TREATMENT

The PANACEA® seed treatment package protects the seed and
seedlings from disease in the early stages of plant development.

Advantages of polymers (protective coatings or film coatings):

■ The seed is safer for handling and inhibits pollution.

■ It serves as an adhesive for the other important seed
treatment products.

■ It limits the amount of "chemical dust" during handling.

■ It improves the flow of seed through the planter and
plantability.

Benefits of Insecticides:

Insecticides provide effective systemic protection of the
seedlings against most soil insects that can cause plant
population losses, e.g. Black Maize Beetles (Heteronychus arator),
Asystylus larvae (Asystylus atomaculatus), Ground Weevils
(Protostrophus spp.), Wireworms (Elateridae), Lesser False
Wireworms/Dusty Surface Beetles (Gonocephalus and
Mesomorphus spp.), Greater False Wireworms (Somaticus spp.)
and Leafhoppers (Cicadulina mbila).

Nematode Protection:

The biological component VOTiVO™ (Bacillus firmus) serves as a
biological barrier and protects the roots from early attacks of
ground nematodes. It acts as a bio-stimulant that improves
growth and reduces early attacks by nematodes.

When the seed is planted and the environmental conditions
favour germination, the bacteria begins to grow and multiply.
These bacteria feed on the root discharges and multiply as the
root develops. It forms a biological barrier and protects the roots
during the critical stage of plant establishment against nematode
damage. The bacteria compete with the nematodes for space and
nutrients.

Advantages of polymers (protective coatings or film coatings):

■ The seed is safer for handling and inhibits pollution.

■ It serves as an adhesive for the other important seed
treatment products.

■ It limits the amount of “chemical dust” during handling.

■ It improves the flow of seed through the planter and
plantability.
PROVEN PERFORMANCE FOR PEACE OF MIND

PANNAR maintains an outstanding performance record in the ARC national trials.
For the past three years PANNAR has delivered five out of the top ten sunflower hybrids.

The PANNAR sunflower hybrid package performs well in all sunflower production regions of South Africa. This diverse hybrid package provides good, stable performance with good risk management to help sustain your farming operation. The South African farmer can plant PANNAR’s sunflower range with peace of mind, knowing that these hybrids incorporate the best genetic potential and technology on the market.

The conventional sunflower package performs exceptionally well, is stable and adaptable. In addition to these hybrids, PANNAR also markets high yielding hybrids with the CLEARFIELD® PLUS trait. The PANNAR package also features a hybrid high in oleic acid, with high mono-unsaturated fatty acid content. High oleic sunflower oil is addressing the trend for healthier deep-frying oils.

Planting a hybrid package is recommended to strategically manage disease and drought stress. It is also recommended that farmers stagger their planting dates for enhanced risk management.

CLEARFIELD® PRODUCTION SYSTEM

PANNAR markets a range of CLEARFIELD® PLUS sunflower hybrids that compete head to head with the conventional hybrids, setting a totally new precedent for crop rotation. EURO-LIGHTNING® PLUS provides effective post-emergence control of a variety of broadleaf weeds and grasses. Hybrids with the CLEARFIELD® PLUS trait (suffix CLP) are only registered for the use of EURO-LIGHTNING® PLUS herbicide (Reg. No. L10316)! PANNAR does not support the use of any other post-emergent herbicide on our CLP hybrids that has not been tested or proven in official qualification trials. The inherent herbicide resistance is a natural mutation; the hybrids are not genetically modified and all sunflower hybrids are GMO-free.

PAN 7102CLP – An excellent choice for high potential conditions

- This single cross hybrid contains the CLEARFIELD® PLUS trait, with the benefit of improved weed control.
- In terms of yield potential and stability, it competes on an equal footing with the conventional hybrids.
- This hybrid is based on PAN 7049 genetics.
- PAN 7102CLP is slightly quicker than the other hybrids. It is especially suitable to plant in alternating blocks with PAN 7156CLP to better manage the risk of possible Sclerotinia infection at flowering.

PAN 7156CLP – A high potential hybrid with CLEARFIELD® PLUS

- This is a high potential single cross hybrid with exceptional stability.
- In terms of yield potential and stability, it competes on an equal footing with the conventional hybrids.
- This hybrid is a top performer in the PANNAR and ARC national trials.
- PAN 7156CLP is similar to PAN 7049.

PAN 7160CLP – This top seller is in a class of its own

- This three-way cross delivered top performance in the ARC trials over the past four seasons.
- It has extremely good yield potential and reliability at all yield levels. It is renowned for performance and stability.
- It contains the CLEARFIELD® PLUS trait, with the benefit of improved weed control.
- Based on PAN 7100 genetics, it has the same yield potential and stability as the conventional hybrids.
CONVENTIONAL HYBRID PACKAGE

PANNAR’s versatile conventional hybrids are known for their excellent performance and wide adaptability. A diversified hybrid package is recommended for good risk management and sustainable productivity.

PAN 7100 – Excellent yield potential and stability
■ Maintains top performance in the ARCs’ trials.
■ A full season three-way cross with good stability and adaptability.
■ Good yield potential and excellent oil content.
■ Recommended as part of the main planting for all sunflower production regions.

PAN 7057 – Maintains a good performance record
■ Wide adaptability across all production regions with excellent oil content.
■ A top seller especially in the North West production region.
■ A formidable package in combination with PAN 7080 and PAN 7100. Recommended for the main planting in all production regions.

PAN 7080 – The hybrid for high yield potential situations
■ This hybrid has been one of the top performers in the PANNAR and ARC national trials over the past nine years.
■ This hybrid has excellent yield potential and has maintained a phenomenal performance record.
■ It is well adapted to all production regions with exceptional stability under varying conditions.
■ A very popular hybrid in the PANNAR range.
■ Recommended for all sunflower production regions.
■ The hybrid performs extremely well on the high potential sandy soils of the western production region.

HIGH OLEIC ACID HYBRID

PAN 7158HO – High oleic acid hybrid
■ A medium season hybrid, well adapted to all sunflower production regions.
■ A very uniform plant type.
■ Oleic acid content of 80% and higher, producing a healthier oil type.
■ This hybrid is based on the genetic model of PAN 7080 and is highly competitive with the conventional range of hybrids.

NOTES
**SUNFLOWER HYBRIDS - AGRONOMIC CHARACTERISTICS**

<table>
<thead>
<tr>
<th>General Characteristics</th>
<th>PAN 7158HO</th>
<th>PAN 7102CLP</th>
<th>PAN 7156CLP</th>
<th>PAN 7160CLP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growing season</td>
<td>Medium</td>
<td>Medium Late</td>
<td>Medium</td>
<td>Medium</td>
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<tr>
<td><strong>HIGH OLEIC</strong></td>
<td></td>
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<tr>
<td>± Days to 50% flowering*</td>
<td>75</td>
<td>75</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>± Days to physiological maturity*</td>
<td>130</td>
<td>130</td>
<td>130</td>
<td>130</td>
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<tr>
<td>± Days to harvest</td>
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<td>150 – 155</td>
<td>150 – 155</td>
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<tr>
<td>Uniformity (9 = Excellent; 1 = Poor)</td>
<td>9</td>
<td>9</td>
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<td>7</td>
</tr>
<tr>
<td>Standability (9 = Excellent; 1 = Poor)</td>
<td>8</td>
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<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Plant height (cm)</td>
<td>170</td>
<td>170</td>
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<tr>
<td>Average oil content</td>
<td>42%</td>
<td>43%</td>
<td>40%</td>
<td>42%</td>
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<table>
<thead>
<tr>
<th>General Characteristics</th>
<th>PAN 7100</th>
<th>PAN 7057</th>
<th>PAN 7080</th>
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<tr>
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<td><strong>CONVENTIONAL</strong></td>
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<td></td>
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<tr>
<td>± Days to 50% flowering*</td>
<td>76</td>
<td>77</td>
<td>77</td>
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<tr>
<td>± Days to physiological maturity*</td>
<td>130</td>
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<td>± Days to harvest</td>
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<td>Uniformity (9 = Excellent; 1 = Poor)</td>
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<td>9</td>
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<tr>
<td>Standability (9 = Excellent; 1 = Poor)</td>
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<td>9</td>
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<tr>
<td>Plant height (cm)</td>
<td>160</td>
<td>170</td>
<td>170</td>
</tr>
<tr>
<td>Average oil content</td>
<td>43%</td>
<td>43%</td>
<td>40%</td>
</tr>
</tbody>
</table>

Uniformity and Standability
- Excellent (9)
- Average (5)
- Poor (1)

* Varies according to planting date and temperatures during growing season.
CLEARFIELD® PLUS HERBICIDE PROGRAMME
- Successful control, apply at the 2-6 leaf stage of weeds
- Poor water quality use Imiboost at 2%
- Soil application 150-200 litres water/ha

EURO-LIGHTNING® PLUS at 2 l/ha

<table>
<thead>
<tr>
<th>Subsequent Crops</th>
<th>Waiting Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEARFIELD® PLUS sunflower</td>
<td>NONE</td>
</tr>
<tr>
<td>Maize</td>
<td>10 months</td>
</tr>
<tr>
<td>Wheat</td>
<td>4 months</td>
</tr>
<tr>
<td>All other crops</td>
<td>20 months</td>
</tr>
</tbody>
</table>

Valid only if the correct amount of EURO-LIGHTNING® PLUS is applied and a minimum of 350 mm rain falls.

Lasso MT / Dual Gold / Metagan Gold

Euro-lightning® Plus
- Ideal at 4 leaf (V4) stage of weeds
- Top dressing
- Weed control important

Diseases’ biggest influence
- Critical moisture requirement
- Physiological maturity
- Ready for harvest 10% moisture

Development stages*

<table>
<thead>
<tr>
<th>VO</th>
<th>V1</th>
<th>V2</th>
<th>V3</th>
<th>V4</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
<th>R7</th>
<th>R8</th>
<th>R9</th>
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<tbody>
<tr>
<td>10</td>
<td>15</td>
<td>20</td>
<td>35</td>
<td>45</td>
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<td>65</td>
<td>75</td>
<td>85</td>
<td>95</td>
<td>115</td>
<td>135</td>
<td>155</td>
<td></td>
</tr>
</tbody>
</table>

Days after planting

Germination and seedling establishment
Leaf development
Flower bud stage
Flowering stage
Seed development

* Planting date/climate may influence development.
SUPERB SOYBEANS, GROW AND REAP SUCCESS

Farming for the future means building your farming operation on a long-term vision and objectives that will keep you in business for generations. The versatile PANNAR soybean package has unparalleled stability at different yield potential levels and over different production regions. It is a proven and safe choice.

A good rotation programme in your cropping system is one of the practices that will sustain your farming business for the future. Soybeans offer many advantages as a rotation crop, particularly in combination with maize in the medium and high potential areas. PANNAR’s soybean package is versatile and should give you the best chance to succeed.

PANNAR has access to the very best commercial soybean cultivars, either locally bred or accessed from around the world. PANNAR’s policy is to release the best varieties possible into the South African market, regardless of where they originate. You can always be certain that if a cultivar appears in our cultivar range, it has already been thoroughly tested by the most comprehensive evaluation programme in the country.

There has been a renewed interest in the soybean cultivar market in recent times. PANNAR is the only seed company that has supported the soybean industry with cultivar research and development unabated since the 1970’s, so for us, the growth in the market is a reward for perseverance. Together, we will continue to farm for the future.

PANNAR has managed to contain the cultivar package to six exceptional products, offering a full range of maturity classes that will cover almost all planting date/production area combinations. In our case, less is more.
GLYPHOSATE TOLERANT CULTIVARS

4 Maturity Class: Cool regions

PAN 1454R – First across the finish line
- A quick-maturing cultivar for regions with a restricted growing season, especially if there is a need to combine early.
- Robust cultivar ideally suited to the cooler eastern Highveld (Mpumalanga and eastern Free State).
- High oil content.
- Not recommended for the warm production regions.

5 Maturity Class: Temperate regions and later planting in warm regions (Irrigation)

PAN 1532R – Widely adapted to cool and temperate regions
- Very good, stable performance across all production areas.
- An excellent irrigated cultivar.
- First choice for wheat/soybean rotation.
- Upright plant type, well adapted to high plant populations and narrow inter-row spacing.
- Very good standability and harvests easily.

PAN 1521R – The Jewel in the Soybean Crown
- If we need to single out a cultivar for preferential planting it is PAN 1521R.
- Unmatched yield potential and stability (yield probability) over different yield potentials, production areas and seasons.
- Equally well suited to cool, moderate and hot regions.
- This cultivar has a characteristically strong and deeply developed root system which comes into its own in the water table soils of the western production regions. It is underwritten by its popularity in these areas.
- A winning combination of yield and agronomic characteristics.

6 Maturity Class: Early planting in temperate areas and main planting in warm dryland areas

PAN 1623R – High yield leader
- Unmatched yield potential and stability (yield probability) over different yield potentials and production areas.
- Yield data shows that it is a good choice in all production regions, however, a medium late maturity may prove to be an impractical solution in the cool region.
- Strong robust plant with good standability that quickly covers the rows.
- The cultivar’s strong root system makes it very suitable for the water table soils in the western production region.

PAN 1644R – Wingman (NEW)
- If you currently plant PAN 1623R, you need to try PAN 1644R.
- Has very similar attributes to PAN 1623R, but has some improved features that make it even more versatile.

PAN 1653R – Narrow leaf, broad adaptation (NEW)
- Those of you who remember PAN 737R are going to love this variety.
- Has a narrow leaf shape which permits better light penetration into the canopy.
- Combines short stature with good standability and wide area adaptation.

NOTES

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SOYBEAN CULTIVARS - AGRONOMIC CHARACTERISTICS

<table>
<thead>
<tr>
<th>General Characteristics</th>
<th>PAN 1454R</th>
<th>PAN 1532R</th>
<th>PAN 1521R</th>
<th>PAN 1623R</th>
<th>PAN 1644R</th>
<th>PAN 1653R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growing season (MG*)</td>
<td>4.3</td>
<td>5.3</td>
<td>5.7</td>
<td>6.1</td>
<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>Growth type**</td>
<td>Ind.</td>
<td>Ind.</td>
<td>Ind.</td>
<td>Ind.</td>
<td>Ind.</td>
<td>Det.</td>
</tr>
<tr>
<td>Relative maturity</td>
<td>Early</td>
<td>Early</td>
<td>Early</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Plant height*** (cm)</td>
<td>78</td>
<td>63</td>
<td>82</td>
<td>82</td>
<td>78</td>
<td>69</td>
</tr>
<tr>
<td>Pod height (9 = High, 1 = Low)</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Standability (9 = Excellent, 1 = Poor)</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Shattering resistance (9 = Excellent, 1 = Poor)</td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Average seed count**** (seeds/kg)</td>
<td>4 650</td>
<td>5 759</td>
<td>5 865</td>
<td>6 000</td>
<td>6 222</td>
<td>5 971</td>
</tr>
</tbody>
</table>

Recommended Plant Population

| Early planting           | 300 000  | 350 000  | 300 000  | 300 000  | 300 000  | 300 000  |
| Late planting date or narrow row widths | 450 000  | 550 000  | 450 000  | 380 000  | 380 000  | 450 000  |

* PAN 1454R should be limited to a smaller portion of the total package. PAN 1521R and PAN 1623R are two established cultivars with exceptional performance and are complemented by PAN 1532R, a slightly quicker alternative and the two new additions to our range; PAN 1644R and PAN 1653R.

SOYBEAN CULTIVARS RECOMMENDATIONS FOR THE DIFFERENT REGIONS

<table>
<thead>
<tr>
<th>Growth Class (MG)</th>
<th>Cool regions</th>
<th>Eastern temperate regions</th>
<th>Dry warm regions</th>
<th>Hot regions (Irrigation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early (4-5)</td>
<td>PAN 1454R*</td>
<td>PAN 1454R*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium (5-6)</td>
<td>PAN 1532R</td>
<td>PAN 1532R</td>
<td>PAN 1521R</td>
<td></td>
</tr>
<tr>
<td>Late (6-7)</td>
<td>PAN 1623R</td>
<td>PAN 1623R</td>
<td>PAN 1644R</td>
<td>PAN 1653R</td>
</tr>
</tbody>
</table>

* Maturity Group (MG). **Indeterminate (Ind.) or Determinate (Det.). *** Varies according to planting date and temperatures during growing season. **** Seed mass may vary between seasons.
Two breeding programmes contribute to the vast majority of the cultivars released. A relatively small number of farmers contribute to the grain deliveries, while a small number of traders influence local grain prices and China dictates the quality and price of imported dry beans.

This said, it is a good business to be in. Dry bean farmers are specialists and it will remain this way for years to come, even if mechanisation of harvesting reduces the risk factor. PANNAR has been at the forefront of the drive to mechanise dry bean production and has been focusing on the transfer of technology to assist farmers in mechanising their harvesting process. Progress is, however, slow in both cultivar development and improvement in cultural practices which will facilitate mechanisation.

Grain quality attributes are important criteria in our selection process. Despite the complexity of breeding for a number of additional selection criteria, PANNAR has made important improvements. Because of the overriding effects of season, farmers would generally not be aware of incremental yield gains. When seasonal fluctuations are removed, our data shows that yield improvement in our sugar bean programme is 130 kg per hectare per year, calculated over ten seasons at Delmas. Whilst new cultivars are slow to reach the market for a multitude of reasons, the mechanism that delivers the new cultivars to your farm gate is healthy. Embrace the crop; it is the sharpest arrow in our multi-crop quiver.

RED SPECKLED BEANS
A top-performing, red speckled bean package that offers exceptional yield performance and stability. The package provides a cultivar for all production systems, from the high input, mechanised operation to the low input, subsistence setup.

PAN 148 – A proven performer
- The most popular cultivar in the PANNAR dry bean package.
- An integral player in dry bean production in South Africa.
- Maintains excellent performance in multi-season national strip trials in Mpumalanga and the eastern Free State.
- Well adapted to all production regions and still the cultivar of choice in Mpumalanga and the eastern Free State.
- Responds well to fungicide spray in the high humidity environments.

PAN 9292 – The best in the west
- A cultivar similar to PAN 116, but with some significant improvements.
- PAN 9292 is especially well suited to the North West production regions. It displays good general disease resistance, wide area adaptability and increased yield stability.
- Grain quality attributes are good. The smaller, rounder bean reduces potential for mechanical damage during harvest.
- The good all-round disease resistance makes it an excellent choice for both small-scale producers and large commercial farmers.
**PAN 9216 – Red flower, indeterminate growth habit**
- Good performance in statistical trials and strip trials.
- Potential for direct mechanical harvesting with a combine harvester.
- Important agronomic traits: indeterminate growth habit; excellent standability; large seeded.
- Good bean quality attributes and superior cooking characteristics make this variety the consumers’ first choice in sugar bean varieties.
- Usually ready to harvest about seven to ten days earlier than the other cultivars, with the advantage of delivering good quality beans to the market earlier.
- Unique red flower makes it recognisable anywhere in the world.
- Excellent general disease tolerance, including Rust, Angular Leaf Spot, root rots and BCMV resistance.

**SMALL WHITE CANNING BEAN**
A winning combination of exceptional yield, disease tolerance and grain quality attributes.

**PAN 123 – A top performer**
- The first choice in small white canning beans in South Africa.
- Accepted by all major canning companies.
- Good yield potential and Rust resistance makes for a widely adapted cultivar.

**PAN 9141 – A new top performer (NEW)**
- Restricted release while factory-scale canning tests are conducted. Preliminary results are very promising.
- Has similar agronomic qualities to PAN 123, but has improved resistance to Anthracnose.
- Has been selected to have a more uniform grain size, to improve canning grade.

---

### DRY BEAN CULTIVARS - AGRONOMIC CHARACTERISTICS

<table>
<thead>
<tr>
<th>General Characteristics</th>
<th>PAN 148</th>
<th>PAN 9292</th>
<th>PAN 9216</th>
<th>PAN 123</th>
<th>PAN 9141</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bean type</td>
<td>Red speckled</td>
<td>Red speckled</td>
<td>Red speckled</td>
<td>Small white canning</td>
<td>Small white canning</td>
</tr>
<tr>
<td>± Days to 50% flower</td>
<td>50 – 60</td>
<td>50 – 60</td>
<td>50 – 60</td>
<td>50 – 60</td>
<td>50 – 60</td>
</tr>
<tr>
<td>± Days to maturity</td>
<td>100 – 120</td>
<td>100 – 120</td>
<td>100 – 120</td>
<td>100 – 120</td>
<td>100 – 120</td>
</tr>
<tr>
<td>Planting date – Temperate areas</td>
<td>Dec/mid-Jan</td>
<td>Dec/mid-Jan</td>
<td>Dec/mid-Jan</td>
<td>Dec/mid-Jan</td>
<td>Dec/mid-Jan</td>
</tr>
</tbody>
</table>

#### Diseases**
- Angular Leaf Spot (ALS) | S | R | R | R | R |
- Rust | MR | MR | MR | R | R |
- BCMV | R | R | R | R | R |
- Seed size: seeds/kg*** | 2 390 | 2 330 | 1 950 | 4 500 | 4 150 |

#### Recommended Planting Rate (kg/ha)

<table>
<thead>
<tr>
<th></th>
<th>90 cm rows x 7.5 cm (148 000 seeds/ha)</th>
<th>90 cm rows x 5 cm (222 000 seeds/ha)</th>
<th>75 cm rows x 7.5 cm (178 000 seeds/ha)</th>
<th>Dryland (small white) (245 000 seeds/ha)</th>
<th>Irrigation and High Potential Dryland (small white) (260 000 seeds/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 cm rows x 7.5 cm (148 000 seeds/ha)</td>
<td>62</td>
<td>64</td>
<td>76</td>
<td>33</td>
<td>36</td>
</tr>
<tr>
<td>90 cm rows x 5 cm (222 000 seeds/ha)</td>
<td>93</td>
<td>95</td>
<td>114</td>
<td>49</td>
<td>53</td>
</tr>
<tr>
<td>75 cm rows x 7.5 cm (178 000 seeds/ha)</td>
<td>74</td>
<td>76</td>
<td>91</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td>Dryland (small white) (245 000 seeds/ha)</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>Irrigation and High Potential Dryland (small white) (260 000 seeds/ha)</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
</tr>
</tbody>
</table>

*Indeterminate (Ind.) / Determinate (Det.). **Diseases: S - Susceptible, MS - Moderately Susceptible, MR - Moderately Resistant, R - Good Resistance. ***Seed mass may vary between seasons.

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INCOMPARABLE GRAIN SORGHUM PACKAGE

PANNAR SEED’s hybrids are the backbone of grain sorghum production in South Africa. The sorghum breeding programme has been running since 1978 and is one of the oldest in the world.

The PANNAR grain sorghum package maintains an excellent record of performance in the ARC and PANNAR trials. PAN 8816 is recommended as the main planting for all grain sorghum production regions. PAN 8816 has excellent yield stability and area adaptability. It is a malting hybrid, also very suitable for the milling industry.

Medium Late Growth Class

PAN 8816 – The best hybrid in the PANNAR package
■ Excellent yield potential and stability.
■ Very uniform growth habit and good standability. Attractive plant type.
■ Large-seeded grain, high bushel weight and good threshability.
■ Classified GM; good malt quality.
■ Good general leaf disease tolerance.
■ Good Head Smut tolerance. Plant where Head Smut problems have occurred in the past.
■ Open head facilitates spraying.

Late Growth Class

PAN 8625 – Speciality bitter sorghum
■ Outstanding yield performance and agronomic characteristics.
■ Widely adapted.
■ Bitter grain type; classified GH. Good malt quality.
■ Medium plant height with good standability.
■ Good tolerance to Head Smut.

NOTES

GRAIN SORGHUM HYBRIDS – AGRONOMIC CHARACTERISTICS

<table>
<thead>
<tr>
<th>General Characteristics</th>
<th>PAN 8816</th>
<th>PAN 8625</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growing season</td>
<td>Medium Late</td>
<td>Late</td>
</tr>
<tr>
<td>± Days to 50% flowering</td>
<td>76 – 79</td>
<td>79 – 82</td>
</tr>
<tr>
<td>± Days to harvest</td>
<td>135 – 142</td>
<td>140 – 145</td>
</tr>
<tr>
<td>Plant height (cm)</td>
<td>112 – 117</td>
<td>120 – 130</td>
</tr>
<tr>
<td>Uniformity (9 = Excellent, 1 = Poor)</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Standability (9 = Excellent, 1 = Poor)</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Threshability (9 = Excellent, 1 = Poor)</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Head Smut (9 = Excellent, 1 = Poor)</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Plant colour</td>
<td>Purple</td>
<td>Purple</td>
</tr>
<tr>
<td>Grading</td>
<td>GM</td>
<td>GH</td>
</tr>
<tr>
<td>Seed colour</td>
<td>Red</td>
<td>Brown</td>
</tr>
</tbody>
</table>

Seed size* (seeds/kg)

<table>
<thead>
<tr>
<th>Class</th>
<th>PAN 8816</th>
<th>PAN 8625</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>25 500</td>
<td>26 500</td>
</tr>
<tr>
<td>Class 2</td>
<td>34 000</td>
<td>33 600</td>
</tr>
</tbody>
</table>

* Estimated seed mass may vary between seasons

Uniformity, Standability, Threshability and Head Smut Tolerance

<table>
<thead>
<tr>
<th>Excellent</th>
<th>Average</th>
<th>Poor</th>
</tr>
</thead>
</table>
Forage sorghum is an annual forage crop suitable for grazing, green chop, foggage or silage depending on the cultivar’s characteristics.

It is important when selecting a hybrid to identify the correct hybrid for a specific application as their characteristics may vary significantly with regards to regeneration (regrowth), yield potential and sugar content.

PANNAR forage sorghum hybrids are high yielding forage crops that can be manipulated by flowering date and growth habit to make it ideal for silage, grazing, foggage or green chop.

These crops require nitrogen fertilisation to achieve their production potential. A guideline is 16 kg N per tonne of dry material (DM). Apply 40-60 kg N per ha after every use. Ask your PANNAR representative for the yield potential of your area. The above is simply a guideline and various other factors also play a role in the recommended nitrogen application rate. The best planting time is from October to December, as soon as the minimum soil temperature rises above 18°C.

### Hybrid Characteristics and Use

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Characteristics and Use</th>
<th>Seeding Rate kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PAN 868</strong></td>
<td>Late flowering Sorghum x Sudan hybrid: This hybrid has the best yield potential in the package. The high yield potential of PAN 868 comes into its own when it is allowed to grow out once to 75 to 100 cm and then used as grazing, for ensiling, in a green chop system (cut and carry) or as foggage in early winter (May/June). It flowers at about 130 days, which means that it stays in the vegetative stage for an extended period of time and produces an abundance of good quality, palatable leaves and stems. The sucrose content of the hybrid is high (approximately 15 Brix). It has very good drought and leaf disease tolerance. The standability is excellent for a hybrid that grows up to 2.8 m tall.</td>
<td>Rainfall &lt;600 mm: Rows: 4-6; Broadcast: 15  Rainfall &gt;600 mm: Rows: 7-15; Broadcast: 20</td>
</tr>
<tr>
<td><strong>PAN 888</strong></td>
<td>Normal Sorghum x Sudan hybrid: The best regrowth capacity in the package. Use in a grazing system where it is utilised two to three times as grazing or for green chop purposes. Graze when the forage reaches a height of approximately 75 to 100 cm; graze it to a height of no less than 25 cm for good regrowth. Flowering date is approximately 75 to 80 days. Widely adapted with the best drought tolerance in the package.</td>
<td>Rainfall &lt;600 mm: Rows: 4-6; Broadcast: 15  Rainfall &gt;600 mm: Rows: 7-15; Broadcast: 20</td>
</tr>
<tr>
<td><strong>SILAGE KING</strong></td>
<td>Grain Sorghum x Sorgo Hybrids: Sweet sorghum plant type with bitter grain. The plant remains very palatable after maturity and frosting. Pre-eminently suitable for foggage or silage. It produces highly competitive yields and is a cheaper alternative to other well-known sweet sorghum types. Flowering date is approximately 78 days.</td>
<td>Rainfall &lt;600 mm: Rows: 4-6; Broadcast: 12-15  Rainfall &gt;600 mm: Rows: 7-12; Broadcast: 15-20</td>
</tr>
</tbody>
</table>

General: Take necessary prussic acid precautions when any forage sorghum is grazed. Forage sorghum is not suitable for horses.

### FORAGE SORGHUM USER GUIDE

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Hybrid Type</th>
<th>Days to 50% Flowering</th>
<th>Sucrose Content Brix %</th>
<th>Regrowth</th>
<th>Grazing</th>
<th>Silage</th>
<th>Foggage</th>
<th>Cut and Feed (Green Chop)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAN 868</td>
<td>Sorghum x Sudan</td>
<td>130</td>
<td>15.3%</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>PAN 888</td>
<td>Sorghum x Sudan</td>
<td>81</td>
<td>11.7%</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>SILAGE KING</td>
<td>Sorghum x Sorgo</td>
<td>81</td>
<td>16.5%</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1 = Excellent  3 = Above Average  5 = Average  7 = Below Average
PANNAR’s wheat package has made a major contribution to local wheat production. The breeding programme focuses on improving the yield potential of wheat production in South Africa, as well as the development of cultivars with new sources of resistance to Russian Wheat Aphid and Rust.

PANNAR cultivars maintain an excellent track record in the ARC Small Grains Institute’s national trials, confirming the package’s excellent yield potential and adaptability in the various local production regions.

PANNAR’s dryland package consists of true winter and intermediate wheat cultivars. There are several highlights. PAN 3111 is a true winter type with excellent yield potential and has excellent standability due to its shorter straw. PAN 3161 is a true winter type and has a combination of good aluminium tolerance and Russian Wheat Aphid resistance. PAN 3161 seedlings grow vigorously and the cultivar is an excellent choice on fields with a wind risk. In the intermediate growing period, PAN 3368 is a good choice for later plantings in the central and eastern production areas of the Free State.

PANNAR is a “one-stop seed supplier” in the various irrigation areas. The package boasts high potential irrigation cultivars divided into three growing period classes: medium late, medium and medium early. The package consists of PAN 3497, PAN 3471, PAN 3541 and PAN 3400. With its slightly longer growing period compared to PAN 3471, PAN 3497 it is more suitable for early plantings. PAN 3400, with a quick growing period and excellent yield potential is ideal for later plantings. PAN 3541 is a new medium growing season cultivar destined as the new flagship and to replace PAN 3471 in the future. The PANNAR package is the obvious choice for the irrigation farmer.

Wheat cultivars classified as resistant to Rust and Russian Wheat Aphid must, as with susceptible cultivars, still be monitored for the occurrence of these pests, since new races/biotypes that have the ability to overcome the resistance may develop. Factors such as disease pressure, appearance of symptoms at the seedling stage and prevailing climatic conditions may also affect the effectiveness or expression of resistance.

### WHEAT CULTIVARS

<table>
<thead>
<tr>
<th>Growth Class</th>
<th>Cultivar</th>
<th>Area Adaptability and Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DRYLAND, SUMMER RAINFALL AREAS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>True Winter Types</td>
<td>PAN 3111</td>
<td>Exceptionally wide area adaptability with top performance in the ARC national trials. High yield potential, good aluminium tolerance and excellent standability provided by its shorter straw length. It has a high cold requirement and is more suited to early plantings.</td>
</tr>
<tr>
<td>True Winter Types</td>
<td>PAN 3161</td>
<td>Good yield potential and wide area adaptability, exceptionally strong seedling vigour and shorter straw length providing excellent standability. Russian Wheat Aphid resistance and good aluminium tolerance.</td>
</tr>
<tr>
<td>Intermediate Type</td>
<td>PAN 3368</td>
<td>A top performer in the eastern Free State. Resistant to two of the Russian Wheat Aphid biotypes and particularly suitable for cultivation in the central and eastern Free State.</td>
</tr>
<tr>
<td><strong>IRRIGATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Types</td>
<td>PAN 3497</td>
<td>The medium late grower PAN 3497 is the number one choice for early plantings. It has an excellent yield potential at early plantings and achieves top performance in the ARC Small Grains Institute’s trials. It has good stooling capacity, grading characteristics and tolerance to Stripe Rust. The cultivar is susceptible to Leaf Rust.</td>
</tr>
<tr>
<td>Spring Types</td>
<td>PAN 3471</td>
<td>PAN 3471 is certainly the top performer in the medium growth class. PAN 3471 is the top choice for the main planting due to its consistent and reliable performance across various seasons, planting dates, environments and at different yield potential levels. PAN 3471 has good straw strength and standability. It displays good resistance to Stripe and Leaf Rust pathotypes.</td>
</tr>
<tr>
<td>NEW</td>
<td>PAN 3541</td>
<td>PAN 3541 is PANNAR’s new generation cultivar in the medium growth class. PAN 3541 sets a new standard for yield in this growth class which will ensure that the cultivar will become the new PANNAR flagship cultivar. PAN 3541 has good straw strength, standability and tolerance against the prevailing Stripe and Leaf rust pathotypes.</td>
</tr>
<tr>
<td></td>
<td>PAN 3400</td>
<td>A top performer in the medium to early growing period class and a good choice for planting at medium to late planting dates. Its shorter straw makes PAN 3400 suitable for higher seeding rates as required by later planting dates to compensate for the reduced stooling capacity as temperatures rise later in the season. Irrespective of its growing period, PAN 3400 competes favourably yield-wise. PAN 3400 is resistant to Stripe Rust and moderately susceptible to Leaf Rust.</td>
</tr>
<tr>
<td><strong>WESTERN CAPE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Types</td>
<td>PAN 3471</td>
<td>Has a high yield potential, good straw strength, standability and shows good resistance to current Leaf Rust and Stripe Rust pathogenic types. PAN 3471 is very well suited to dryland cultivation in the Western Cape, as supported by its performance in the ARC test results.</td>
</tr>
<tr>
<td></td>
<td>PAN 3408</td>
<td>A cultivar with a medium late growing period with stable, consistently high yields over many seasons in the Rûens and Swartland production areas. PAN 3408 is resistant to Stripe Rust and moderately susceptible to Leaf and Stem Rust.</td>
</tr>
</tbody>
</table>
**WHEAT CULTIVARS**

Optimum Planting Date and Seeding Rate Recommendations

**DRYLAND**

**Region 10a North Western Free State**

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Planting Date</th>
<th>Seeding Rate kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAN 3161</td>
<td>7/5 – 10/6</td>
<td>20 – 30</td>
</tr>
<tr>
<td>PAN 3111</td>
<td>21/4 – 20/5</td>
<td>15 – 20</td>
</tr>
</tbody>
</table>

**Region 10b South Western Free State**

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Planting Date</th>
<th>Seeding Rate kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAN 3161</td>
<td>7/5 – 31/5</td>
<td>20 – 30</td>
</tr>
<tr>
<td>PAN 3111</td>
<td>21/4 – 15/5</td>
<td>15 – 20</td>
</tr>
</tbody>
</table>

**Region 11 Central Free State**

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Planting Date</th>
<th>Seeding Rate kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAN 3368</td>
<td>25/5 – 30/6</td>
<td>25 – 30</td>
</tr>
<tr>
<td>PAN 3161</td>
<td>1/5 – 15/6</td>
<td>25 – 30</td>
</tr>
<tr>
<td>PAN 3111</td>
<td>24/4 – 31/3</td>
<td>15 – 20</td>
</tr>
</tbody>
</table>

**Region 12 Eastern Free State**

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Planting Date</th>
<th>Seeding Rate kg/ha</th>
</tr>
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<tbody>
<tr>
<td>PAN 3368</td>
<td>20/6 – 7/8</td>
<td>25 – 40</td>
</tr>
<tr>
<td>PAN 3161</td>
<td>1/6 – 20/7</td>
<td>25 – 30</td>
</tr>
<tr>
<td>PAN 3111</td>
<td>1/6 – 30/6</td>
<td>15 – 30</td>
</tr>
</tbody>
</table>

**IRRIGATION**

More accurate area planting date recommendations are provided in the ARC-SGI Wheat Production Guide. The information below provides only broad guidelines.

**Cooler Central Irrigation Areas**  
*(Lower Vaal and Orange River Areas)*

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Planting Date</th>
<th>Seeding Rate kg/ha</th>
<th>Plants/m²</th>
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</thead>
<tbody>
<tr>
<td>PAN 3400</td>
<td>10/6 – 31/7</td>
<td>80 – 120</td>
<td>180 – 250</td>
</tr>
<tr>
<td>PAN 3471</td>
<td>5/6 – 25/7</td>
<td>75 – 110</td>
<td>170 – 250</td>
</tr>
<tr>
<td>PAN 3541</td>
<td>5/6 – 25/7</td>
<td>75 – 110</td>
<td>170 – 250</td>
</tr>
<tr>
<td>PAN 3497</td>
<td>1/6 – 20/7</td>
<td>75 – 110</td>
<td>170 – 250</td>
</tr>
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</table>

**Warmer Irrigation Areas** *(Limpopo)*

<table>
<thead>
<tr>
<th>Cultivar</th>
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<th>Seeding Rate kg/ha</th>
<th>Plants/m²</th>
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</thead>
<tbody>
<tr>
<td>PAN 3400</td>
<td>15/5 – 15/7</td>
<td>90 – 120</td>
<td>225 – 300</td>
</tr>
<tr>
<td>PAN 3471</td>
<td>6/5 – 5/7</td>
<td>80 – 110</td>
<td>180 – 250</td>
</tr>
<tr>
<td>PAN 3541</td>
<td>5/6 – 5/7</td>
<td>80 – 110</td>
<td>180 – 250</td>
</tr>
<tr>
<td>PAN 3497</td>
<td>1/5 – 25/6</td>
<td>75 – 100</td>
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**Eastern Highveld**

<table>
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<th>Plants/m²</th>
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</thead>
<tbody>
<tr>
<td>PAN 3400</td>
<td>1/7 – 5/8</td>
<td>80 – 120</td>
<td>180 – 250</td>
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<td>PAN 3541</td>
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<td>PAN 3497</td>
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**KwaZulu-Natal**

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<tr>
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<td>90 – 120</td>
<td>225 – 300</td>
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<td>180 – 250</td>
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<td>PAN 3497</td>
<td>1/6 – 30/6</td>
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**Western Cape**

<table>
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<tr>
<th>Cultivar</th>
<th>Swartland</th>
<th>West and South Rûens</th>
<th>East Rûens</th>
<th>Plants/m²</th>
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<tbody>
<tr>
<td>PAN 3408 (PTR)</td>
<td>1/5 – 31/5</td>
<td>1/5 – 31/5</td>
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<td>175 – 225</td>
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<td>PAN 3471 (PTR)</td>
<td>1/5 – 31/5</td>
<td>1/5 – 31/5</td>
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**NOTES**

PTR: Cultivar protected by plant breeder's rights.

Wheat seed is available from:

- Overberg Agri at Moorreesburg: PAN 3408 and PAN 3471.
- PANNAR's depot at Swellendam: PAN 3471.

**Map courtesy of ARC-SGI**

Dryland Wheat Production
- Mpumalanga/Gauteng Limpopo
- (Springbokvlakte)
- Eastern Cape
- Central Free State
- Eastern Free State
- North Western Free State
- South Western Free State
### General Characteristics

<table>
<thead>
<tr>
<th></th>
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<th>PAN 3471</th>
<th>PAN 3541</th>
<th>PAN 3497</th>
<th>PAN 3471</th>
<th>PAN 3408</th>
<th>PAN 3368</th>
<th>PAN 3161</th>
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</thead>
<tbody>
<tr>
<td>± Days to 50% flowering*</td>
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<td>± Days to physiological maturity*</td>
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<td>165</td>
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<td>169</td>
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<tr>
<td>± Days to harvest (&lt;15% moisture)*</td>
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### Yield Potential and Adaptability

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### Agronomic/Quality Characteristics

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<th>Central Free State</th>
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<tbody>
<tr>
<td>Hectolitre Mass</td>
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<tr>
<td>Pre-harvest Sprouting Tolerance**</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>3</td>
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<td>Aluminium Tolerance**</td>
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<td>Coleoptile Length</td>
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<td>Russian Wheat Aphid Resistance#</td>
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<td>Leaf Rust***</td>
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<td>5</td>
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<td>7</td>
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<td>Stripe Rust***</td>
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</table>

*Planting date/climate may influence data.
† Suited to supplementary irrigation in winter dryland region.
**Data obtained from ARC-Small Grains Institute.
#Biotype info: PAN 3161 and PAN 3368 are resistant against RWASA1 and 2.
***Screened for reaction to prevailing pathotypes.
# FORAGE CROPS

PANNAR SEED is a leader in the certified pasture seed industry and complies with the regulations for genetic and physical quality set by the Seed Certification Scheme. PANNAR is synonymous with quality. We have a wealth of expertise in planted pasture and a wide range of versatile cultivars to meet your unique needs. PANNAR’s forage crops are thoroughly tested under local growing conditions for high carrying capacity and palatability for sustainable animal production.

## MILD OR WINTER FORAGE CROPS

<table>
<thead>
<tr>
<th>Crops</th>
<th>Establishment</th>
<th>Seeding Rate (kg/Ha)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>RYEGRASS: SUKARI</td>
<td>Feb – Apr or Aug – Sept</td>
<td>Irrigation 25 – 30 20 – 25</td>
<td>Pastures for milk, fat lamb production and finishing of weaners. Establish under irrigation and use during autumn, winter and spring. SUKARI is a diploid, Italian ryegrass that lasts exceptionally long through the summer and in some cases, even until autumn. High dry matter and sugar content. Outstanding high midwinter production. Italian types can be established in early autumn (February/March) or alternatively early spring after the major frosts (August/September), in which case it should provide pasture for about 13 months.</td>
</tr>
<tr>
<td>RYEGRASS: VOYAGER 10</td>
<td>Feb – Apr</td>
<td>Irrigation 35 30 – 35</td>
<td>A 100% tetraploid Westervold type for maximum ryegrass yields in the mid-winter up to the end of October. Westervold types should be planted in early autumn (February/March) and used from April/May until October/December.</td>
</tr>
<tr>
<td>PERENNIAL RYEGRASS: BASE</td>
<td>Feb – Apr or Aug – Sept</td>
<td>Irrigation 30 – 35 25 – 35</td>
<td>A tetraploid perennial ryegrass. Excellent dry material production with very good persistence and midsummer production. Handles grazing pressure particularly well for a ryegrass. Excellent pasture when planted as a mixture with clover. These ryegrass types are not strongly perennial and have to be re-established every three to four years.</td>
</tr>
<tr>
<td>JAPANESE RADISH: ENDURANCE</td>
<td>Dec – Jan/Feb</td>
<td>Supl. Irrig./Dryland – 2 – 3.5</td>
<td>ENDURANCE is a unique, late flowering, soft leaved fodder radish. It usually produces good quality root and leaf material right through to the end of August. In some areas production can extend into September. Dry matter is highly digestible. For cattle it is best pulled or ploughed out and fed whole. It is usually not cold or frost sensitive. Requires approximately 350 mm rainfall over the four-month growing period.</td>
</tr>
<tr>
<td>OATS: LE TUCANA</td>
<td>Feb – Mar</td>
<td>Supl. Irrig./Dryland 50 – 70 40 – 50</td>
<td>LE TUCANA produces excellent autumn and winter forage. Very palatable, high yielding and exhibits good cold tolerance. MAJORIS is a medium season white oats cultivar with an excellent yield potential, Rust resistance and cold tolerance.</td>
</tr>
<tr>
<td>TRITICALE: PAN 248</td>
<td>Feb – Apr</td>
<td>Supl. Irrig./Dryland 60 – 80 35 – 45</td>
<td>PAN 248 is a relatively quick triticale type that is ideally suited to green feed production on shallow, marginal soils. Suitable for providing grazing in the late autumn and winter months. Also suitable for silage in the winter rainfall areas. PAN 299 is a true winter type triticale with a very good stooling ability. This cultivar is particularly suitable for use in the late winter and spring months. PAN 299 develops slowly initially and is ready for grazing after 12 to 13 weeks. Triticale is more cold tolerant than oats.</td>
</tr>
<tr>
<td>STOOLING RYE:</td>
<td>Mar – Apr</td>
<td>Supl. Irrig./Dryland 40 – 60 30 – 50</td>
<td>A quick, spring type stooling rye also suitable for late plantings in June, July and even the beginning of August when the demand for forage is high. High yield potential. Not as palatable as oats, but more cold tolerant.</td>
</tr>
</tbody>
</table>
### SUMMARY FORAGE CROPS

<table>
<thead>
<tr>
<th>Crops</th>
<th>Establishment</th>
<th>Seeding Rate (kg/Ha)</th>
<th>Characteristics</th>
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<tbody>
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<td></td>
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<td>Rainfall (mm)</td>
<td>Broadcast</td>
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<tr>
<td>FORAGE SORGHUM</td>
<td>End Oct – Jan</td>
<td>&lt;600 mm</td>
<td>15</td>
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<tr>
<td></td>
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<td>&gt;600 mm</td>
<td>20</td>
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<tr>
<td>FORAGE SORGHUM (see page 44)</td>
<td></td>
<td>&lt;600 mm</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;600 mm</td>
<td>20</td>
</tr>
<tr>
<td>TEFF: ROOIBERG</td>
<td>Oct – Dec</td>
<td>&gt;600 mm</td>
<td>15 – 20</td>
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<tr>
<td>LUCERNE:</td>
<td></td>
<td>Cool areas:</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>&lt;700</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>700 – 900</td>
<td>–</td>
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<td></td>
<td></td>
<td>Irrigation</td>
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<td>PAN 4770 Intermediate</td>
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<td>Feb – Apr</td>
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<td>Dormant</td>
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<td>PAN 4992 Strong</td>
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<td>700 – 900</td>
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<tr>
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<td></td>
<td>Irrigation</td>
<td>20 – 25</td>
</tr>
</tbody>
</table>

**NOTES**

- PAN 4770 is an intermediate dormancy Class 7 and very robust variety, suitable for hay production or grazing. Relatively thin stems. Retains its bottommost leaves well. High yield potential.
- PAN 4992 is a highly winter active, high yielding non-dormant Class 9 variety, especially suited for hay production. Exceptional seedling vigour, very leafy and has an upright growth habit.
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**AGRONOMIST**
Gerhard Engelbrecht  
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RSA Regional Map

Sales Representatives

<table>
<thead>
<tr>
<th>Region</th>
<th>Representative</th>
<th>Contact Number</th>
</tr>
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<tbody>
<tr>
<td>Bela-Bela</td>
<td>Christo Jacobs</td>
<td>083 283 4251</td>
</tr>
<tr>
<td>Bethal</td>
<td>Willem du Plessis</td>
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<td>Bloemfontein</td>
<td>Charl van der Merwe</td>
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<td>Bloemhof/Christiana/Vaalharts/Barkley Wes</td>
<td>Christo Nel</td>
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<tr>
<td>Bothaville</td>
<td>Robbie Prehn (Robvil)</td>
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<td>Paul Minnaar</td>
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<td>Ciskei/Eastern Cape</td>
<td>Phelisa Ndayi</td>
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<td>Hoopstad</td>
<td>Hannelie Tait</td>
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<td>Hopetown/Douglas</td>
<td>Raan Janse van Vuuren</td>
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<td>Jacobdal</td>
<td>Fanie Schoeman</td>
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<td>Phillip Nel</td>
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<td>Jan Heymans</td>
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<td>Andrew du Plessis</td>
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<td>Ben Dunhin</td>
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<td>Lydenburg</td>
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<td>Reggie Mchunu</td>
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<td>Eugène Marias</td>
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<td>Nelia Louw</td>
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<td>Port Elizabeth</td>
<td>Darryl Lloyd</td>
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<td>Potchefstroom/Vereeniging</td>
<td>Stephan le Roux</td>
<td>078 612 4065</td>
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<td>Prieska/Upington</td>
<td>Johannes Fourie</td>
<td>083 260 4182</td>
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<td>Ras Meintjes</td>
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<td>Pokkenos Otto</td>
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<td>Schweizer-Reneke/Vryburg</td>
<td>Adriaan Jacobs</td>
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<td>Senekal/Ficksburg</td>
<td>Rossouw Grobbelaar</td>
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<td>Welkom</td>
<td>Le Roux Breytenbach</td>
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<tr>
<td>Zululand</td>
<td>Welcome Zulu</td>
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License agreements and stewardship for maize, soybeans and sunflowers

MAIZE

BIOGENE® is a registered trademark of Pioneer. BIOGENE® brand seed is distributed by PANNAR SEED (PTY) LTD.

SC 701 Developed by SEED CO. Sold under exclusive licence by PANNAR SEED (PTY) LTD in South Africa and Namibia.

ROUNDUP READY®, YIELDGARD®, YIELDGARD II®, GENUITY® and design are trademarks used under license from Monsanto Technology LLC.

NB! The management of possible insect resistance to the Bt gene is legally binding. The planting of a refuge as per regulations is required where any Bt hybrids are used (B and BR). Refer to the schematic guidelines on page 30.

SOYBEANS

All PANNAR cultivars are tested using the rhizobial strain WB74 nodule-forming bacterial inoculant. All yield data is generated using this strain, which means that if a farmer chooses to use a different strain of rhizobium, the yield information and cultivar recommendations provided may be irrelevant.

Glyphosate Tolerant

Always follow grain marketing, stewardship practices and pesticide label directions. Varieties that are glyphosate tolerant (including those designated by the letter “R” in the product code) contain genes that confer tolerance to glyphosate herbicides. Glyphosate herbicides will kill crops that are not tolerant to glyphosate.

DISCLAIMER

The information contained in this catalogue is based on long-term results. It is given in good faith and PANNAR does not accept any legal liability in terms thereof. Information regarding disease tolerance is based on available research data as at 2018. The disease tolerance ratings are not absolute, but only guidelines and may change depending of the prevailing environmental and cultivation conditions.

All products are subject to plant-breeders’ rights and any propagation or sale of such seed is prohibited by law.

CLEARFIELD® PLUS SUNFLOWER STEWARDSHIP GUIDELINES

Always grow CLEARFIELD® PLUS sunflower in a three-year rotation with other crops, i.e. non-CLEARFIELD wheat / maize/sunflower.

- Breaks the cycle of continuous sunflower production and allows use of alternate mode-of-action herbicides and tillage.
- Promotes good agronomics by reducing disease and insect pressure in sunflower.

Use alternate (non-ALS) mode-of-action herbicides with activity on sunflower in the rotational crop, i.e. growth regulator or photosynthesis inhibitor.

- Reduces the selection pressure from continuous dependence on the ALS-inhibiting acetolactate synthase herbicide.
- Provides alternate mode-of-action to control volunteer CLEARFIELD® PLUS sunflower and other ALS resistant weeds present.

Limit the sole reliance on ALS herbicides to no more than two out of four years in the same field.

- Where applicable, use sequential or tank mix partner herbicides with multiple modes-of-action on target weed species in the sunflower crop and in rotational crops.

Do not plant CLEARFIELD® PLUS sunflower on fields with a history of heavy wild sunflower infestation.

- Reduces the threat of outcrossing of CLEARFIELD® PLUS sunflower with wild sunflower.

Control wild sunflower in areas adjacent to CLEARFIELD® PLUS sunflower fields (road ditches, field borders and fence rows) through the use of non-ALS herbicides and/or mowing prior to seed set.

- Minimises the potential of cross-pollination of wild-type sunflowers with CLEARFIELD® PLUS sunflowers.
- Promotes good sanitation practices by eliminating vectors for insects and disease.

Control emerged wild sunflower prior to planting CLEARFIELD® PLUS sunflower with non-ALS burndown herbicides (no-till/min-till) or tillage (conventional-till).

- Reduces reliance on ALS herbicide in controlling wild sunflower.
- Eliminates any emerged naturally occurring biotype that may be resistant to ALS-inhibiting herbicides.

Registration No. 1986/002148/07
Website: www.pannar.com
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