

# Soya bean cultivar selection for the best results

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Following the ground-breaking study by Hall in 1930, indicating that “soya beans can be grown in those parts of Natal (KwaZulu-Natal) having good rainfall”, the second largest grain crop was produced during the 2021/22 season (2 201 000 tons on 925 300ha).

A combination of improved yields together with favourable soya bean prices, as well as the benefit of increased soil health in a crop rotation system are the main drivers for the rapid expansion of soya bean production. However, the added input costs also contributed to the expansion of soya beans to the drier and non-traditional soya bean production areas, resulting in the Free State being the largest soya bean production area (415 000ha during the 2021/22 season).

## Locality matters

The productivity of soya bean cultivars varies from one locality to the other, owing to locality-specific genotype x environment interactions as soya beans are sensitive to daylight as well as the prevailing temperature, resulting in the division of the soya bean production areas into cool, moderate and warm sections. This is also why the planting date will influence the length of the growing season of a given cultivar.

Cultivar evaluation trials are an indispensable source of information for producers, given the yield benefits that accumulate by virtue of being able to adequately identify cultivars with reasonable adaptability that fits in their localities to ensure optimum yield and profitability.

When cultivars are selected, it is important to establish which locality has similar climatic conditions. The following are other important characteristics to consider during cultivar selection.

**Table 1: Average number of days to 50% flowering and harvesting of cultivars during the 2021/22 growing season for warm, moderate and cool production areas.**

| Cultivar       | Days to 50% flowering |                       |                   | Days to harvest   |                       |                   |
|----------------|-----------------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|
|                | Warm <sup>1</sup>     | Moderate <sup>2</sup> | Cool <sup>3</sup> | Warm <sup>4</sup> | Moderate <sup>5</sup> | Cool <sup>6</sup> |
| PAN 1479 R     | 40                    | 45                    | 60                | 140               | 139                   | 154               |
| DM 5953 RSF    | 39                    | 46                    | 59                | 140               | 139                   | 149               |
| NS 5258 R      | 40                    | 48                    | 59                | 141               | 145                   | 149               |
| RA 4918 R      | 40                    | 48                    | 61                | 144               | 139                   | 150               |
| DM 5351 RSF    | 41                    | 47                    | 58                | 144               | 139                   | 152               |
| SSS 5449 (tuc) | 50                    | 58                    | 70                | 143               | 139                   | 156               |
| Y540           | 49                    | 60                    | 70                | 146               | 143                   | 155               |
| RA 565 R       | 53                    | 61                    | 74                | 150               | 145                   | 159               |
| LS 6851 R      | 48                    | 60                    | 70                | 149               | 149                   | 162               |
| SSS 5052 (tuc) | 64                    | 61                    | 76                | 150               | 148                   | 161               |
| P57T19 R       | 60                    | 63                    | 72                | 150               | 151                   | 163               |
| PAN 1555 R     | 59                    | 62                    | 76                | 149               | 151                   | 160               |
| PAN 1521 R     | 59                    | 64                    | 78                | 150               | 148                   | 161               |
| DM 5302 RSF    | 49                    | 60                    | 75                | 142               | 142                   | 156               |
| RA5921 R       | 56                    | 62                    | 76                | 150               | 152                   | 167               |
| PAN 1588R      | 61                    | 64                    | 77                | 152               | 151                   | 165               |
| NS 5909 R      | 61                    | 63                    | 76                | 150               | 147                   | 167               |
| RA 660 R       | 56                    | 63                    | 76                | 150               | 147                   | 163               |
| DM 59R03       | 55                    | 62                    | 79                | 152               | 153                   | 168               |
| LS 6164 R      | 56                    | 63                    | 78                | 156               | 153                   | 171               |
| LS 6860 R      | 66                    | 65                    | 76                | 153               | 152                   | 174               |
| P62T16R        | 57                    | 64                    | 80                | 153               | 158                   | 174               |
| Y627           | 61                    | 64                    | 79                | 155               | 154                   | 168               |
| PAN 1692 R     | 63                    | 67                    | 86                | 151               | 153                   | 168               |
| P64T39 R       | 58                    | 68                    | 82                | 157               | 156                   | 175               |
| NS 6448 R      | 56                    | 65                    | 79                | 153               | 153                   | 174               |
| RA6520RS       | 61                    | 65                    | 84                | 158               | 158                   | 178               |
| Y657           | 63                    | 65                    | 79                | 152               | 150                   | 164               |
| DM 68R09       | 64                    | 66                    | 81                | 159               | 155                   | 175               |
| PAN 1644 R     | 54                    | 65                    | 77                | 153               | 153                   | 168               |
| DM 6,8i RR     | 59                    | 65                    | 78                | 158               | 156                   | 174               |
| P71T74 R       | 64                    | 66                    | 82                | 159               | 158                   | 177               |

1: Average of four localities; 2: average of six localities; 3: average of seven localities; 4: average of five localities; 5: average of five localities; 6: average of seven localities. Days to flowering: Average of 50% of plants with one flower. Days to harvest: Average of pods is mature, brittle and dry.

**Table 2: Grouping of localities according to warm, moderate and cool production areas during the 2021/22 growing season.**

| Warm                                                                                                                                                                                                                                                                                                                                         | Moderate                                                                                                                                                                                                                                                                                                                                                      | Cool                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Groblersdal Agri Seed, irrigated, Limpopo</li> <li>Groblersdal Agricultural Research Council, irrigated, Limpopo</li> <li>Hoopstad, dryland, Free State</li> <li>Pyramid, irrigated</li> <li>Schweizer-Reneke PD1, dryland, North West</li> <li>Schweizer-Reneke, PD2, dryland, North West</li> </ul> | <ul style="list-style-type: none"> <li>Barberspan, dryland, North West</li> <li>Bergville, irrigated, KwaZulu-Natal</li> <li>Cedara, dryland, KwaZulu-Natal</li> <li>Greytown, dryland, KwaZulu-Natal</li> <li>Kroonstad, dryland, Free State</li> <li>Leeudoringstad, dryland, North West</li> <li>Potchefstroom Limagrain, irrigated, North West</li> </ul> | <ul style="list-style-type: none"> <li>Bapsfontein, irrigated, Mpumalanga</li> <li>Belfast, dryland, Mpumalanga</li> <li>Bethlehem PD1, irrigated, Free State</li> <li>Bethlehem PD2, irrigated, Free State</li> <li>Clarens, dryland, Free State</li> <li>Delmas, dryland, Mpumalanga</li> <li>Standerton, dryland, Mpumalanga</li> <li>Winterton, dryland, KwaZulu-Natal</li> </ul> |

**Table 3: General information on registered soya bean cultivars evaluated in 2021/22.**

| Cultivar       | Maturity grouping | Growth habit <sup>1</sup> | Pod height <sup>2</sup> |          |      | Shattering <sup>3</sup> |          |      | Supplier                  |
|----------------|-------------------|---------------------------|-------------------------|----------|------|-------------------------|----------|------|---------------------------|
|                |                   |                           | Cool                    | Moderate | Warm | Cool                    | Moderate | Warm |                           |
| PAN 1479 R     | 4,7               | I                         | 5                       | 8        | 8    | 1,14                    | 1        | 1    | Pannar                    |
| DM 5953 RSF    | 4,8               | I                         | 7                       | 10       | 10   | 1,05                    | 1        | 1    | GDM Seeds                 |
| NS 5258 R      | 4,9               | I                         | 5                       | 9        | 9    | 1,24                    | 1        | 1    | Limagrain (K2)            |
| RA 4918 R      | 4,9               | I                         | 7                       | 10       | 12   | 1,24                    | 1        | 1    | Agri Seed                 |
| DM 5351 RSF    | 5,1               | I                         | 7                       | 11       | 10   | 1,10                    | 1        | 1    | GDM Seeds                 |
| SSS 5449 (tuc) | 5,2               | I                         | 10                      | 12       | 13   | 1,14                    | 1        | 1    | Syngenta (Sensako)        |
| Y540           | 5,4               | I                         | 9                       | 11       | 14   | 1                       | 1        | 1    | Southern Hemisphere Seeds |
| RA 565 R       | 5,5               | I                         | 11                      | 13       | 13   | 1                       | 1        | 1    | Agri Seed                 |
| LS 6851 R      | 5,5               | D                         | 9                       | 13       | 8    | 1                       | 1        | 1    | Limagrain                 |
| SSS 5052 (tuc) | 5,5               | I                         | 11                      | 14       | 16   | 1                       | 1        | 1    | Sensako                   |
| P57T19 R       | 5,7               | I                         | 14                      | 16       | 17   | 1                       | 1        | 1    | Corteva Agriscience RSA   |
| PAN 1555 R     | 5,7               | I                         | 14                      | 16       | 21   | 1                       | 1        | 1    | Pannar                    |
| PAN 1521 R     | 5,7               | I                         | 13                      | 15       | 17   | 1                       | 1        | 1    | Pannar                    |
| DM 5302 RSF    | 5,7               | I                         | 10                      | 12       | 11   | 1                       | 1        | 1    | GDM Seeds                 |
| RA5921 R       | 5,9               | I                         | 10                      | 10       | 14   | 1                       | 1        | 1    | Agri Seed                 |
| PAN 1588 R     | 5,9               | I                         | 13                      | 14       | 16   | 1                       | 1        | 1    | Pannar                    |
| NS 5909 R      | 5,9               | I                         | 13                      | 16       | 17   | 1                       | 1        | 1    | Limagrain (K2)            |
| RA 660 R       | 6                 | I                         | 11                      | 14       | 16   | 1                       | 1        | 1    | Agri Seed                 |
| DM 59R03       | 6                 | I                         | 14                      | 15       | 19   | 1                       | 1        | 1    | GDM Seeds                 |
| LS 6164 R      | 6,1               | I                         | 14                      | 14       | 21   | 1                       | 1        | 1    | Limagrain                 |
| LS 6860 R      | 6,2               | I                         | 14                      | 16       | 20   | 1                       | 1        | 1    | Limagrain                 |
| P62T16R        | 6,2               | I                         | 13                      | 15       | 17   | 1                       | 1        | 1    | Corteva Agriscience RSA   |
| Y627           | 6,2               | I                         | 11                      | 13       | 19   | 1                       | 1        | 1    | Southern Hemisphere Seeds |
| PAN 1692 R     | 6,3               | I                         | 14                      | 14       | 16   | 1                       | 1        | 1    | Pannar                    |
| P64T39 R       | 6,4               | I                         | 14                      | 15       | 19   | 1                       | 1        | 1    | Pioneer                   |
| NS 6448 R      | 6,4               | SD                        | 10                      | 14       | 13   | 1                       | 1        | 1    | Limagrain (K2)            |
| RA650RS        | 6,5               | I                         | 15                      | 15       | 19   | 1                       | 1        | 1    | Agri Seed                 |
| Y657           | 6,5               | I                         | 13                      | 15       | 23   | 1                       | 1        | 1    | Southern Hemisphere Seeds |
| DM 68R09       | 6,6               | I                         | 11                      | 14       | 18   | 1                       | 1        | 1    | GDM Seeds                 |
| PAN 1644 R     | 6,7               | I                         | 11                      | 15       | 21   | 1                       | 1        | 1    | Pannar                    |
| DM 6,8i RR     | 6,8               | I                         | 11                      | 18       | 21   | 1                       | 1        | 1    | GDM Seeds                 |
| P71T74 R       | 7,1               | I                         | 14                      | 16       | 24   | 1,14                    | 1        | 1    | Pioneer                   |

<sup>1</sup>D – determinate, I – indeterminate, SD – semi-determinate; <sup>2</sup>Pod height (cm); <sup>3</sup>Tendency to shatter is evaluated on a scale from 1 to 5, where 1 equals few and five equals numerous.

### Days to 50% flowering and harvest

The number of days from planting to flowering is a critical stage in the development of the soya bean plant. The number of days to harvest maturity is used to determine the length of the growing season of a cultivar; however, it is influenced by climate and planting date (Table 1).

### Pod and plant height

Pod and plant height has an impact on the ability to harvest the crop (Table 3). A relationship exists between pod and plant height and the relative length of the growing season. Cultivars with a shorter growing season tend to have lower plant and pod heights compared to longer growing season cultivars under similar growing conditions. Both characteristics are also influenced by production practices. Narrower inter- and intra-row spacing will increase pod height significantly.

### Seed shattering

Tolerance against shattering can play an important role during unfavourable harvesting conditions (Table 3). Shattering is one of the most challenging aspects of soya bean production and it is recommended to plant a package of different maturity grouping cultivars to stagger the harvesting process.

### Standability

Standability (lodging) is influenced by plant height, which tends to increase when overcast weather and extremely wet and windy conditions occur, which could result in a higher lodging percentage of plants. Some cultivars withstand lodging better than others under the same conditions.

### Yield

Yield indicates the genetic adaptation and suitability of a cultivar that is to be planted in a specific area. During the 2021/22 season, 32 cultivars were included in the national soya bean cultivar trials. Data from 21 localities was acceptable for statistical analyses. It is recommended to use the yield results with the yield probability and stability values for a more accurate cultivar choice (Tables 4, 5 and 6). Determine which yield potential recommendations must be made for. The next step is to consult the

**Table 4: Yield probability (%) of cultivars in the 2019/20, 2020/21 and 2021/22 seasons for the cooler dryland production areas at different yield potentials.**

| Cultivar       | Yield potential (t/ha) |    |     |    |     |    |     |    | Regression line |      |
|----------------|------------------------|----|-----|----|-----|----|-----|----|-----------------|------|
|                | 1,5                    | 2  | 2,5 | 3  | 3,5 | 4  | 4,5 | 5  | FProb           | R2   |
| DM 5953 RSF    | 91                     | 88 | 84  | 79 | 73  | 65 | 57  | 50 | 0,0038          | 0,38 |
| DM 5351 RSF    | 79                     | 75 | 70  | 64 | 57  | 51 | 44  | 38 | 0,0027          | 0,40 |
| SSS 5449 (tuc) | 65                     | 58 | 51  | 44 | 36  | 29 | 23  | 19 | <0,001          | 0,64 |
| LS 6851 R      | 65                     | 60 | 53  | 46 | 39  | 33 | 27  | 23 | <0,001          | 0,67 |
| SSS 5052 (tuc) | 25                     | 25 | 26  | 26 | 27  | 28 | 30  | 31 | <0,001          | 0,79 |
| PAN 1555 R     | 36                     | 36 | 37  | 39 | 40  | 41 | 43  | 44 | <0,001          | 0,79 |
| PAN 1521 R     | 88                     | 85 | 81  | 77 | 71  | 64 | 58  | 51 | <0,001          | 0,74 |
| DM 5302 RSF    | 79                     | 74 | 68  | 61 | 53  | 46 | 38  | 31 | <0,001          | 0,58 |
| NS 5909 R      | 26                     | 31 | 36  | 43 | 49  | 56 | 62  | 68 | <0,001          | 0,89 |
| LS 6164 R      | 43                     | 42 | 42  | 41 | 40  | 40 | 40  | 40 | <0,001          | 0,83 |
| LS 6860 R      | 11                     | 15 | 20  | 25 | 32  | 39 | 47  | 56 | <0,001          | 0,88 |
| P64T39 R       | 49                     | 51 | 53  | 55 | 57  | 59 | 60  | 61 | <0,001          | 0,63 |
| NS 6448 R      | 19                     | 23 | 29  | 35 | 43  | 50 | 58  | 65 | <0,001          | 0,72 |
| PAN 1644 R     | 41                     | 45 | 49  | 52 | 57  | 60 | 64  | 67 | <0,001          | 0,84 |
| DM 6,8i RR     | 37                     | 41 | 46  | 51 | 56  | 61 | 66  | 70 | <0,001          | 0,86 |
| P71T74 R       | 19                     | 27 | 37  | 48 | 60  | 71 | 79  | 86 | <0,001          | 0,85 |

**Table 5: Yield probability (%) of cultivars in the 2019/20, 2020/21 and 2021/22 seasons for the moderate dryland production areas at different yield potentials.**

| Cultivar       | Yield potential (t/ha) |    |     |    |     |    |     |    | Regression line |      |
|----------------|------------------------|----|-----|----|-----|----|-----|----|-----------------|------|
|                | 1,5                    | 2  | 2,5 | 3  | 3,5 | 4  | 4,5 | 5  | FProb           | R2   |
| DM 5953 RSF    | 66                     | 62 | 58  | 53 | 48  | 44 | 40  | 36 | <0,001          | 0,78 |
| DM 5351 RSF    | 12                     | 22 | 36  | 54 | 71  | 83 | 92  | 96 | <0,001          | 0,92 |
| SSS 5449 (tuc) | 40                     | 37 | 33  | 29 | 26  | 24 | 22  | 20 | <0,001          | 0,82 |
| LS 6851 R      | 40                     | 42 | 43  | 46 | 47  | 49 | 51  | 53 | <0,001          | 0,93 |
| SSS 5052 (tuc) | 49                     | 40 | 32  | 24 | 18  | 13 | 9   | 7  | <0,001          | 0,81 |
| PAN 1555 R     | 32                     | 34 | 35  | 38 | 41  | 42 | 46  | 49 | <0,001          | 0,94 |
| PAN 1521 R     | 70                     | 65 | 59  | 53 | 46  | 40 | 34  | 29 | <0,001          | 0,90 |
| DM 5302 RSF    | 36                     | 34 | 33  | 33 | 32  | 31 | 32  | 31 | <0,001          | 0,88 |
| NS 5909 R      | 50                     | 47 | 41  | 36 | 31  | 27 | 25  | 22 | <0,001          | 0,94 |
| LS 6164 R      | 57                     | 54 | 52  | 50 | 47  | 45 | 43  | 40 | <0,001          | 0,87 |
| LS 6860 R      | 39                     | 35 | 31  | 28 | 25  | 23 | 22  | 20 | <0,001          | 0,89 |
| P64T39 R       | 69                     | 69 | 69  | 70 | 69  | 68 | 68  | 67 | <0,001          | 0,87 |
| NS 6448 R      | 63                     | 65 | 66  | 68 | 69  | 68 | 69  | 69 | <0,001          | 0,91 |
| PAN 1644 R     | 62                     | 64 | 65  | 67 | 69  | 70 | 71  | 72 | <0,001          | 0,87 |
| DM 6,8i RR     | 67                     | 70 | 73  | 75 | 77  | 78 | 80  | 80 | <0,001          | 0,80 |

yield probability table at the determining yield potential. From the yield probability table, cultivars with above-average probability values and yield stability should be selected. This will provide the producer with the best chance for a stable, successful yield.

### Cultivar stability

The stability of a cultivar is determined by how much closer the coefficient of determination value is to one, and the smaller the FProb value (preferably <0,1), the more stable the cultivar will be.

**Yield probability**

The yield probability of a cultivar is the potential to achieve an above-average yield at a particular yield potential. For instance, if the yield probability of a cultivar at a particular yield potential equals 60%, the chance to get a yield above the mean of all cultivars is 60% with a 40% chance of obtaining a yield below the mean. Since new cultivars are introduced and some are removed annually, a multi-season yield probability is only possible for a limited number of cultivars.

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**Table 6: Yield probability (%) of cultivars evaluated in the 2019/20, 2020/21 and 2021/22 seasons for the warm production areas at different yield potentials.**

| Cultivar       | Yield potential (t/ha) |     |    |     |    |     |    | Regression line |      |
|----------------|------------------------|-----|----|-----|----|-----|----|-----------------|------|
|                | 2                      | 2,5 | 3  | 3,5 | 4  | 4,5 | 5  | FProb           | R2   |
| DM 5953 RSF    | 46                     | 44  | 43 | 42  | 41 | 39  | 39 | <0,001          | 0,69 |
| DM 5351 RSF    | 38                     | 39  | 40 | 41  | 42 | 43  | 44 | <0,001          | 0,84 |
| SSS 5449 (tuc) | 30                     | 26  | 22 | 18  | 15 | 13  | 11 | <0,001          | 0,78 |
| LS 6851 R      | 62                     | 60  | 57 | 55  | 52 | 49  | 47 | <0,001          | 0,82 |
| SSS 5052 (tuc) | 42                     | 43  | 44 | 44  | 45 | 46  | 47 | <0,001          | 0,91 |
| PAN 1555 R     | 48                     | 46  | 44 | 41  | 39 | 37  | 35 | <0,001          | 0,83 |
| PAN 1521 R     | 63                     | 64  | 64 | 65  | 65 | 65  | 65 | <0,001          | 0,88 |
| DM 5302 RSF    | 36                     | 37  | 40 | 42  | 45 | 48  | 50 | <0,001          | 0,80 |
| NS 5909 R      | 53                     | 54  | 57 | 58  | 60 | 62  | 63 | <0,001          | 0,78 |
| LS 6164 R      | 52                     | 47  | 41 | 36  | 31 | 27  | 24 | <0,001          | 0,82 |
| LS 6860 R      | 56                     | 53  | 51 | 49  | 47 | 44  | 42 | <0,001          | 0,77 |
| P64T39 R       | 63                     | 64  | 65 | 66  | 67 | 67  | 68 | <0,001          | 0,83 |
| NS 6448 R      | 53                     | 54  | 56 | 56  | 58 | 58  | 59 | <0,001          | 0,90 |
| PAN 1644 R     | 50                     | 54  | 59 | 64  | 69 | 72  | 76 | <0,001          | 0,88 |
| DM 6,8i RR     | 55                     | 58  | 61 | 64  | 66 | 68  | 70 | <0,001          | 0,80 |
| P71T74 R       | 55                     | 57  | 59 | 61  | 62 | 64  | 65 | <0,001          | 0,74 |

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