



Dry Peas-2018 Variety: An Innovative High Yielding And Powdery Mildew Resistant Dry Pea, Rich Source Of Protein

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Abstract: Dry pea-2018 is a bold seeded, powdery mildew, pea rust resistant and high yielding variety of dry peas (*Pisum sativum* L.). it is a cross between two genotypes (T-29 × T-37). The hybrid/cross work was started at area of Pulses Institute AARI Faisalabad Pakistan in year 2002-03. It has used pedigree method of selection. The segregating progenies was evaluated and advanced to F5 generation after fulfilling suitable standards. The pure line was routed from F5 source in during 2007-08 and completed evaluate in yield nursery during 2008-09 for further judgment. It was evaluated for two years in station yield trials from 2009-10 to 2010-11 to meet its objectives before moving further to micro yield trials in 2011-12 to 2012-13. It was evaluated in pathological, entomological studies, adaptation yield trials and micro yield trials in the same year for different parameters to complete. The variety dry peas-2018 produced more seed yield (10-56 %) in different yield trials over respective checks with a yield power of 3750 kg hectare⁻¹. It come out first in 2011-12 and 2013-14 in micro and multi locational yield trials. This is bold seeded variety which suitable for commercial purpose. It has 25.3 % protein contents. Its flower size is large, white in color. It takes 75-80 days to flower (50 %) after sowing. Pod size larger than check variety Number 267 having 6.1-6.5 cm in length. The number of pod range 26-65 with 3-4 seeds pod⁻¹ while no pod shattering. grain color is beige shiny, large shape. Seed size is larger than check Number 267 having 170 gram 1000-seed weight. Its plant shape is semi erect with range of 80-160 cm in plant height; taller than check variety Number 267. The plant stem is light green in color. Number of primary branches ranged from 2-6 .it has secondary branches ranged from 7-10. Leaf color is light green, leaf size is large, pubescence is absent and large size leaflets. It indicates good results at seed rate of 60 kg hectare⁻¹ with 15 cm plant to plant and 24-60-0 kg NPK hectare⁻¹. Resistance against powdery mildew, pea rust, bold seeded good yield potential and good are major attributes of new dry pea variety “Dry peas-2018”.

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Key-Word: *Pisum sativum*; genotype; cross-breeding; hybrid; more yielder variety; disease resistant; protein good; Pakistan; quality

INTRODUCTION

In Pakistan, Dry peas was grown on an area of about 14.4 thousand ha in Punjab and produced 11.6 thousand tones of dry peas seed (Agricultural Statistics of Pakistan 2018-19). The Pakistan is using huge amount of rupees for the delivery of this commodity every year to meet its national requirements for human consumption as well as poultry industry. Powdery mildew and Pea rust causes drastic decrease in production when occurs at the time of crop maturity. These diseases may result in crop failure. To protect the dry pea crop from these threats, there is a need to develop material having resistance against powdery mildew and pea rust (Arshad *et al.*, 2008). It is grown worldwide. It is being sown in different countries across the world with major production share from

Canada, Russia, USA, Germany, Ukraine and Australia.

Dry pea is also called Field pea. It is a cheapest source of protein (21-25 %), starch, fiber and is being used as additives in food ingredients and stock feed (Arshad *et al.*, 2008). It has high concentrations of the essential amino acids i.e. lysine and tryptophan, which are lacking in cereals. Field pea is excellent source of copper, fiber, folic acid, manganese, thiamine, iron, magnesium, phosphorus and potassium Bakhsh *et al.*, (2005). It is very effective nitrogen fixers, therefore also grown as a soil fertility enhancer.

It also exhibited tolerance against insect pests. In addition, this variety demand no special production methods and fit better way with the existing agronomic package. In Pakistan, dry pea is growing as a Rabi

pulse crop in the four provinces. In Punjab province only pulses research institute Faisalabad is executing research on this important crop. It is temperate region crop and very little attention has been given for the varietal development in Pakistan. It is an annual herbaceous plant and can be indeterminate and determinate (Malik, 1990). The breeding program at Pulses Research Institute, Faisalabad is aimed at to develop pea rust tolerant, high yielding, powdery mildew resistant varieties of dry pea suitable for both rain-fed and irrigated areas. The variety “dry peas-2018” has sufficient potential for high yield, and tolerance against powdery mildew and pea rust diseases as compared to the existing approved / commercial varieties. This variety will serve as a source of genetic diversity to combat any possible climatic threat.

So, there is a need to include more varieties in the list for general cultivation to overcome disease threat and to sustain dry pea production in the country. The breeding efforts made by Pulses Research Institute, AARI Faisalabad have resulted in developing high yielding, powdery mildew and pea rust resistant variety of dry pea “Dry pea-2018” suitable both for rainfed and irrigated areas of Punjab as well as whole Pakistan.

MATERIALS AND METHODS

Variety “Dry peas-2018” was developed it is a cross between two dry pea local cultivated varieties i.e. T-29 (A local genotype high yield potential and bold seed) and T-37 (A local genotype resistance to pea rust and powdery mildew). The breeding and crossing work was initiated at research area of Pulses Faisalabad Pakistan during the year 2002-03 and pedigree method of selection was used to develop this variety. The Segregating source plants was evaluated for desirable traits and advanced to F₅ generation for further screening procedure. The pure line was selected from F₅ generation in 2007-08 and further evaluated in yield nursery during 2008-09 with progeny code of 09-08. This variety was evaluated for two years (2009-10 to 2010-11) in station yield trials and then was put to micro yield trials to meet targets of crossing work in 2011-12 to 2012-13. Then, it was evaluated for Agronomic, Pathological and Entomological parameters to accomplish during year 2013-14. It was screened in adaptation yield trials and multi locational yield trials during 2013-16. On dry peas only pulses research institute AARI FAISALABAD is working it has no national uniform yield trial. It has two year DUS for variety approval.

Various steps involved in developing and evaluation of new approved variety “Dry peas-2018” are given in Table 1.

Table 1. Different stages of selection of variety ‘Dry peas-2018’

Year	Filial generation trial	Operation
2002-03	Cross was attempted	Seed was harvested
2003-04	F ₁	Seed of F ₁ crosses harvested
2004-05	F ₂	Selection of desirable recombinants
2005-06	F ₃	-do-
2006-07	F ₄	-do-
2007-08	F ₅	Selection of pure line
2008-09	Yield Nursery	Yield data were recorded
2009-10	Station Yield Trial	-do-
2010-11	Station Yield Trial	-do-
2011-12	Micro Yield Trial	-do-
2012-13	Micro Yield Trial	-do-
2013-14	Multi locations Yield Trial	-do-
2013-14	Pathological Studies	-do-
2013-14	Entomological Studies	-do-
2013-14	Agronomic Studies	-do-
2013-16	Adaptation Yield Trial	-do-
2014-16	Distinguishing Uniformity Stability (DUS)	-do-

Hybridization

Source populations i.e. both parents (male and female) were sown in October 2002-03. It maintaining 60 cm distance row to row and 30 cm plant spacing done. Crossing work between parents was made early in the morning time at research area of the pulses Institute Faisalabad pakistan. Emasculation of female flower was done before pollen shedding early in the morning while pollinating immediately with male parent. It used emasculation and pollination procedures as described by Reddy and Singh (1984). Crossed seed (F_0) were taken from female parent and advanced to F_1 population for further process. It has used space

planting.

Generation advancement

A row of 4 meter length for cross seed (F_1 hybrid) was sown along with parents. The seeds were planted using dibbler method of sowing. It maintained 20 cm keeping plant spacing distance and 30 cm row to row distances. Selection of single plants was made in F_2 generation for desirable plants and continued up to F_5 generation. Pure line was selected from F_5 generation which was tested for yield in yield nursery trial during year 2008-09.

1	variety	Dry pea-2018
2	Species	Dry peas / Field peas (<i>Pisum sativum</i> ssp. arvense)
3	Chromosome number	$2n=2x=14$
4	Parentage	T-29 × T-37
5	Pedigree	C.13-13-13-76-112-27-08

Table 2. Yield (kg/ha) performance of Dry Pea-2018 in Station Yield Trials

Year	Trial	Dry pea- 2018 (kg/ha)	Check Number 267 yield (kg/ha)	LSD at 5%	± increase Over check (%)
2008-09	Yield nursery	1624	1309	524	
2009-10	Preliminary yield trial	1609	1297	593	
2010-11	Advanced yield trial	1646	1326	603	
	Average	1626	1311		24 %

Table 3. Yield (kg/ha) performance of Dry pea-2018 in Micro Yield Trials

Year	Trial	Dry pea-2018 (kg/ha)	Check No. 267 yield (kg/ha)	LSD at 5%	± increase Over check (%)
2011-2012	Faisalabad	2164	1109	603	
	Kalurkot, Bhakhar	2777	1007	615	
	BARI Chakwal	578	518	529	
	ARS Karor Layya	3750	2795	494	
	Sahowali,Sialkot	1909	1264	585	
	Average	2236	1339		67 %
2012-2013	Faisalabad	2230	1409	571	
	Kalurkot, Bhakhar	2670	1107	613	
	BARI Chakwal	778	620	523	
	ARS Karor Layya	3450	2585	563	
	Sahowali,Sialkot	2309	1964	617	
	Sahiwal	3101	2230	511	
	RARI Bahawalpur	1219	927	426	
Average	2200	1407		56 %	

Table 4. Yield (kg/ha) performance of “Dry peas-2018” in Agronomic Yield Trial

Sowing date	Yield (Kg/ha)		+ Increase over check (%)
	Dry peas-2018	Number 267 (Check variety)	
15 October	1488	1345	
25 October	1590	1405	
5 November	1449	1421	
15 November	1388	1289	
Average	1479	1365	9 %

Table 5. Yield (kg/ha) performance of variety “Dry pea 2018” in Adaptation Yield Trial

Year	Trial	Dry pea-2018 (kg/ha)	Check No. 267 yield (kg/ha)	LSD at 5%	+ increase Over check (%)
2013-2014	Faisalabad	2254	1109		
	Kalurkot, Bhakhar	2777	1307		
	BARI Chakwal	578	518		
	ARS Karor Layya	3550	2791		
	Sahowali, Sialkot	1809	1364		
	Average	2194	1418		55 %
2014-2015	Faisalabad	2564	1512		
	Kalurkot, Bhakhar	2274	1419		
	BARI Chakwal	874	719		
	ARS Karor Layya	3250	2495		
	Sahowali, Sialkot	1605	1264		
	Sahiwal	2736	1731		
	RARI Bahawalpur	1521	1322		
Average	2118	1495		42 %	
2015-2016	Faisalabad	2054	1723		
	Kalurkot, Bhakhar	2257	1067		
	BARI Chakwal	1078	670		
	ARS Karor Layya	3020	2725		
	Sahowali, Sialkot	1915	1269		
	Sahiwal	2519	1746		
	RARI Bahawalpur	1815	1369		
Average	2094	1510		39 %	

Table 6. Evaluation of dry peas variety “Dry peas-2018” for powdery mildew and pea rust resistance (2013-14)

Varieties	Scale (0-9)	Reaction
Dry peas-2018	1	Resistant
Number 267 (check variety)	1	Resistant

Evaluation in different yield trials

Variety “Dry peas-2018” was first tested in yield nursery trial before evaluating it consecutively for three years in station yield trials and two years in advanced yield trials. Sowing was done around second week of October. All yield trials were laid out in Randomized Complete Block including three replications. The row spacing and distances were maintained at 30 centimeter and 10 centimeter

respectively. Planting was done in single row drill machine to keep four rows four meter length. Plants observed in per acre doing thinning at seedling stage. Included two standard checks in every experiment for comparison. Data on disease reaction (powdery mildew&pea rust) was also recorded following Reddy and Singh (1984).

RESULT and DISCUSSIONS

YIELD TRIAL RESULTS

The results (Table 2 and 3) revealed that yield of variety “Dry peas-2018” ranged from 1609 to 1646 kg per hectare in station yield trials three years from 2008-2010 as compared to standards Number 267(1297-1326 kg per hectare). On an average new variety Dry peas-2018 gave more yield of 578-3750 kg per hectare as compared to checks (518-2795 kg/ha) in micro yield trials respectively, i.e. 62 percent more seed yield grain yield in micro yield trials than check(s). Similar results have been revealed by Bakhsh *et al.*, (2005), Saeed *et al.*, (2018), Yadav *et al.*, (2010) and Arshad *et al.*, 2008.

AGRONOMIC YIELD TRIALS

Sowing/planting date studies were conducted at Agronomic Research Institute Faisalabad to fix specific agronomic requirements of the variety “Dry pea 2018”. This was observed that variety “Dry peas-2018” adhered to the existing production technology and needed no special treatments. The detail is shown in table 4:

ADAPTATION YIELD TRIALS

The results (Table 5) further showed that variety DRY PEA-2018 produced 578 to 3250 kg per hectare grain yield as compared to checks Variety Number 267(518 kg per hectare to 2791 kg per hectare). On an average Dry peas-2018 produced 2194, 2118 and 2094 kg per hectare grain yield during 2013-14, 2014-15 and 2015-16 against 1418 kg per hectare of check No. 267 (2013-14), 1495 kg per hectare (2014-15) and 1510 kg per hectare grain yield (2015-16). New variety Dry pea-2018 exhibited 45 percent higher grain yield than standard variety (Number 267) on an average of 19 locations. It revealed stable yield performance in different environments as well as high acclimatize ratio as revealed by Shafiq *et al.*, (2011), Hussain *et al.*, (2010), Brar *et al.*, (2004), Aslam *et al.*, (2013), Sarwar and Ahmad (2003) and Yadav *et al.*, (2010).

REACTION TOWARDS POWDERY MILDEW AND PEA RUST

The screening studies were carried out at plant pathology section AARI- Faisalabad during 2013-14. The variety “Dry peas-2018” and check variety Number 267 were placed in resistant (R) group. Diseases data were recorded by using (00-09) scale (C.D., Mayee and V.V., Datar. 1986) shown in Table 6.

CHARACTERISTICS OF DRY PEAS VARIETY “DRY PEAS-2018”

Botanical description:

Variety “Dry peas-2018” is a bold seeded, high

yielding, powdery mildew and pea rust resistant. It performs equally well both in irrigated and rained conditions and has vigorous growth habit. Its plant shape is semierect with 80-160 cm in plant height; taller than check variety Number 267. The plant stem is light green in color. It has 2-6 primary branches whereas secondary branches ranged from 7-10. Leaf color is light green, leaf size is large, pubescence is absent and large size leaflets.

Flower, pod and seed characteristics:

Its flower size is large, white in color. It takes 75-80 days to flowering (50 percent). Pod size is larger than check variety, Number 267 having 6.1-6.5 cm in length. It has 26-65 pods with 3-4 seeds pod⁻¹ while no pod shattering. It has seed color beige, shiny l. Seed is bold in size and larger than check variety Number 267 having 170 gram 1000-seed weight.

Quality Characteristics:

This bold seeded variety is suitable for commercial purpose. It has 25.3 % protein contents.

Running title: DRY PEAS-2018 YIELDING AND POWDERY MILDEW RESISTANT DRY PEA, RICH SOURCE OF PROTEIN

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