

Release and Popularization of Cultivars in Rajasthan

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Introduction

Rajasthan is India's second largest state, covering 34 million hectares. Located in the north-west of the country, it borders Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Gujarat, and Pakistan. Given its vast size, it is sparsely populated, with 44 million inhabitants.

The Aravalli range running from south-west to north-east dissects Rajasthan into two parts. The climate on the western side is arid to semi-arid, constituting a north-western region covering 60% of the state. The area is characterised by low and erratic rainfall, extremes of temperatures, low humidity, high wind velocity and dust storms. Eastern and south-eastern regions of the state have a semi-arid to sub-humid and humid climate.

Isohyets essentially run from north-west to south-east. There is a very rapid and marked decrease in rainfall to the west of the Aravalli range, down to 100 mm in Jaisalmar district. On the eastern side of the range, rainfall varies from 500 mm in Ajmer to 1,000 mm in Jhalawar district. The south-western monsoon begins in late June in eastern Rajasthan and lasts until the middle of September. In most places rainfall is normally highest during July and August.

Summer temperatures are 40-45°C and winter temperatures 10-20°C, but extremes of 48°C and 2°C are reached. A sharp decrease in night temperature is experienced throughout the arid and semi-arid regions of western Rajasthan.

Soils are highly variable. Broadly, they can be divided into five groups: sandy or light soils, sandy loam or light medium soils, loam or medium soils, clay loam to loam or heavy soils, and skeletal or shallow rocky and hilly soils.

Rajasthan is predominantly an agricultural state, with nine agro-climatic zones. The socio-economic status of most farmers is low due to poor yields and the harsh climate. Since the advent of the green revolution, the state has made steady progress, and is now nearly self-sufficient in food grains. Production has been boosted by an increase in the area under irrigation, from 4.1-6.1 million hectares between 1982 and 1993, together with the adoption of improved high yielding cultivars in many crops, such as wheat, mustard, cotton and rice.

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Table 7.1 Area, total production and yield of major crops in Rajasthan, 1992-93.

Season/Crop	Area ('000 ha)	Total production ('000 t)	Yield (t ha ⁻¹)
<i>kharif</i>			
Cereals			
Rice	142	75	1.23
Sorghum	778	412	0.53
Pearl millet	4991	2806	0.56
Maize	950	1005	1.06
Minor millets	34	13	0.38
Pulses			
Green gram	381	147	0.39
Kidney beans	1280	351	0.27
Black gram	158	63	0.40
Cowpea	93	40	0.43
Pigeonpea	20	10	0.51
Other pulses	17	11	0.68
Oil Seeds			
Sesame	452	104	0.23
Groundnut	240	266	1.12
Soybean	265	333	1.26
Castor	13	15	1.12
Other Crops			
Cotton	476	1016	0.36
Cluster beans	1824	584	0.32
Sugar cane	24	1129	46.45
<i>rabi</i>			
Wheat	2252	5151	2.29
Barley	244	376	1.54
Chickpea	1449	794	0.55
Rape & mustard	2221	1720	0.77
Taramira	120	81	0.68
Linseed	36	15	0.41

During *kharif*, pearl millet, cluster beans (*guar*) and kidney beans (*moth*) are grown in the north-west, and maize, sorghum, castor, groundnut and soybean in the south-west. During *rabi*, wheat, mustard and chickpea (*gram*) are the main crops in the irrigated areas of the state. Rice and sugarcane are important in the canal irrigated areas of Ganganagar, Kota, Bundi, Jhalawar and Banswara districts, and cotton is important throughout the state in those areas which are not arid. Area of production and amount of production of major crops, for 1992-93, are presented in Table 7.1.

Varietal Identification and Release System

Regulations for state releases in Rajasthan are similar to those at central level. All state releases must go through varietal testing procedure before being finally released by the Rajasthan State Seed Sub-Committee (SSSC). Notification of state releases, however, is made by the Central Sub-Committee following proposals sent by the sponsoring agency through the SSSC.

The Rajasthan State Seed Sub-Committee

The Rajasthan State Seed Sub-Committee has the following members:

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- Agricultural Production Secretary - Chairperson;
- Director of Agriculture, Government of Rajasthan (GOR);
- Director of Research, Rajasthan Agricultural University (RAU);
- Director, Rajasthan State Seed Certification Agency (RSSCA);
- Joint Director of Agriculture, State Seed Testing Laboratories;
- Regional Manager, National Seed Corporation (NSC);
- Two representatives of seed producers;
- Two farmers;
- Representative of the seed trade;
- Secretary, Central Seed Committee — Co-convenor, and
- Deputy Director of Agriculture (Seed)— Co-convenor.

Tenure is for two years. The committee met seven times between June 1985 and December 1991. After a long gap, two meetings were held in May 1994 (Vyas, 1995).

The State Variety Evaluation Committee (SVEC)

The State Variety Evaluation Committee (SVEC) is constituted by the SSSC and has the job of scrutinising release proposals submitted by breeders and sponsoring agencies, and deciding on the suitability of cultivars for release in Rajasthan. The SVEC makes recommendations to the SSSC for release of any cultivar. The SVEC has the following members:-

- Director Research, RAU - Chairman;
- Director of Agriculture, GOR;
- Director of Horticulture, GOR;
- Chief Statistical Officer, GOR, and
- Heads of Departments of Agronomy, Plant Breeding, Plant Pathology, and Entomology of RAU.

Trials and vetting procedures

Material generated by breeders is evaluated in trials at research stations representative of the crop growing areas, under low and high fertility management. Entries showing significantly superior grain yield over national and state checks are then tested in state trials at other locations. The number of locations depends upon the spatial extent of the crop.

After ascertaining a genotype's performance in the state for two years, promising material is channelled into the AICCIP testing procedure (Fig. 7.1). Cultivars are evaluated for three years in the coordinated trials - one year in Initial Evaluation Trials (IETs) and two years in Advanced Varietal Trials (AVTs). Those showing significant superiority over national/state checks with respect to grain yield, maturity and reactions to diseases and pests become eligible for identification by AICCIP at its annual workshop for submitting release proposal to the Central Sub-Committee.

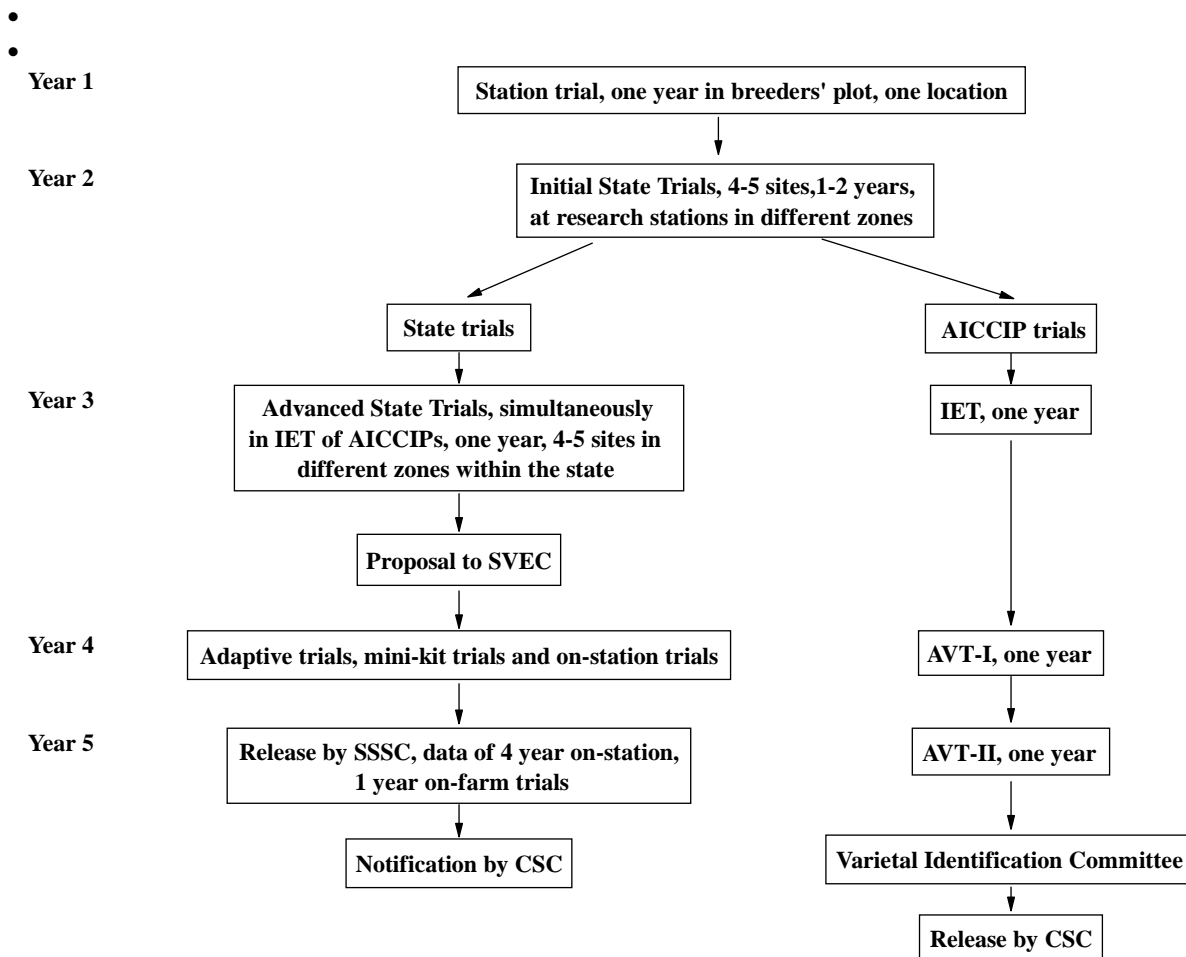


Figure 7.1. Procedure of varietal testing for state and national release in Rajasthan.

When a cultivar has been identified by the varietal identification committee of AICCIP for release only in the state of Rajasthan, it is tested in Adaptive Trials by the State Department of Agriculture. The variety is also tested in pre-release minikits for obtaining farmers' preferences. On-farm demonstrations are also conducted by the breeder before the case is presented to the state committees for its release.

For state release, it is not mandatory for a cultivar to be identified by the national workshop. Data pertaining to the state are sufficient for a variety to be considered for release in Rajasthan by the SVEC and the SSSC. However, the new variety must have been tested at least for one year in AICCIP trials to be eligible for notification. In the third year of testing when the variety has been entered in the IETs of AICCIPs it is simultaneously tested in the state multilocal testing system (Fig. 2.9) in all the regions of importance of the crop. After three years of research station trials a breeder prepares a release proposal in the prescribed proforma and submits it (25 copies) to the SVEC. Key points considered by the SVEC are whether the new variety:

- has been tested in AICCIP trials for at least one year;
- has been tested in Rajasthan for at least three years, and at enough locations that represent where the crop is widely grown;
- has significantly higher grain yield compared to national and state check varieties;
- has desirable maturity (earliness is desirable), and resistance to the prevalent diseases and insect-pests of the area in which crop is grown;

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- has been tested in agronomic trials having varying fertility levels, times of sowing, irrigation levels and plant population, and
- has been tested in Adaptive Trials and other types of on-farm trials.

If the SVEC is satisfied that a cultivar is superior to the most comparable one(s) under cultivation, it is recommended to the SSSC for consideration. The SSSC examines the proposal, and if it is found suitable it is approved for release in the state and recommended to the Central Seed Sub-Committee on Crop Standards, Release and Notification for notification (100 copies).

Private agencies and NGOs are free to put forward material for consideration for release, and the same procedures are followed as for material from the public sector. However to date, out of 55 release proposals submitted by private agencies, only five have been accepted by the SSSC (Table 7.2).

Table 7.2 List of varieties from the private sector that have been approved by the SSSC for cultivation in the Rajasthan.

Crop	Cultivar	Sponsoring company
Pearl millet	Hy. Eknath-302	Nath Seeds Ltd, Aurangabad
Pearl millet	Hy. Nandi-18	New Nandi Seeds Corp., Ahmedabad
Sorghum	Sudan 855 F(SSG)	Pro Agro Co. Ltd, Aurangabad
Sorghum	Sudan 877 F(SSG)	Pioneer Overseas, Hyderabad
Maize	ICI-701	ITC Zeneca Ltd, Bangalore

A cultivar released in another state cannot be accepted as released in Rajasthan until it has gone through the entire process of testing within the state and is approved by both the SVEC and the SSSC. If, however, a variety released in another state was tested in AICCIP trials in Rajasthan for three years it can be tested simultaneously in state trials for the fourth year, and then in adaptive and on-farm trials. Only then can it be proposed for release to the two state committees. The process is less time-consuming for cultivars released at national level. Data for on-farm demonstrations and adaptive trials for one year in the state must be generated so that the cultivar's grain yield, adaptability, maturity and performance under various micro-farming situations can be presented, along with its performance in AICCIP trials conducted in the state, to the SVEC and the SSSC for its release. Further approval of the university's Zonal Research and Extension Advisory Committee (ZREAC) permits the information to be included in the *Package of Practices*, a booklet put out by the Rajasthan Agricultural University (RAU). ZREAC meetings for various zones are held twice a year, once each before *kharif* and *rabi* seasons. Detailed descriptions of national and state released varieties/hybrids of major crops recommended in Rajasthan are given in Annex 4.

Popularisation With Farmers

Popularisation of released cultivars is done under various programmes run by the Department of Agriculture, GOR and the Rajasthan Agricultural University, which both have well-established networks. The government has an agriculture extension wing which covers all 31 districts, and the university has a Directorate of Extension Education which popularises varieties and transfers technology through the state's 31 *Krishi Vigyan Kendras* (KVKs).

Hand-outs are sent to all government officers involved in extension work, from state to district level. Extension workers of RAU and the KVKs, and farmers representatives, are given information by scientists during the twice yearly ZREAC meetings.

Minikits, Adaptive Trials Centre (ATC) trials, block demonstrations, field days, farmers' fairs at research stations and KVK farms, and first-line demonstrations are conducted by research and extension workers of the Department of Agriculture and RAU. NGOs have not yet started such activities on a noticeable scale. Popularisation is also *via* radio, television and print.

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However, there is normally a time-lag of four to six years between release of a cultivar and its commercial cultivation (Table 7.3). This is because of the many steps involved, including the placing of indents for breeder seed, which has to be done a year in advance, the supply of breeder seed, and the production of foundation seed and certified seed. The process is faster for varieties of self-pollinated crops than for hybrids in the cross pollinated crops. Another important factor is whether production is possible within the state (see section on 'Seed production, certification and dissemination'). How quickly cultivars are taken up by farmers also depends on their performance in the field.

Table 7.3 Interval between notification of a cultivar and commercial cultivation by 1993

Crop	Variety	Year	
		Notified	Commercial cultivation
Wheat	Raj 3007	1987	1990
Pearl millet	MH 179	1986	1991
	MH 169	1987	1992
Cotton	RG 8	1988	1991
	RST 9	1992	1993
Maize	G 11	1988	1991
	Sartaj	1988	†
	Surya	1988	†
	D 765	1985	†
	Navjot	1983	1987
	Mahi Kanchan	1992	†
	Kiran	1988	†
Chickpea	RSG 44	1991	1993
	Pusa 209	1983	1991
	Pusa 212	1983	1991
	Pusa 244	1983	†
	BG 267	1988	1993

† These varieties are yet to be cultivated commercially.

Minikits

Minikits are provided by GOI through the development organisations of the Department of Agriculture and Co-operation. For example, the Directorate of Millet Development arranges kits for maize, pearl millet and sorghum and the Directorate of Rice organises kits for rice. Recently, the GOI has been providing special minikits under the cereals programme for pearl millet, maize and rice (Table 7.4).

Pearl millet. Special minikits for pearl millet hybrids MH 179 (ICMH 451), MH 169 and HHB 67 and composite variety ICTP 8203 were distributed in *kharif* 1991. But the following *kharif* season farmers were only given HHB 67 and ICTP 8203. These two varieties were joined by the hybrid HHB 60 in *kharif* 1993 to make up for the non-receipt of maize minikits.

Maize. Special minikits for maize were distributed during *kharif* 1991 and *kharif* 1992, but in 1993 the seed material was not received. In 1991, two composites, Ageti 76 and Navjot, and the hybrid

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D 103 were included. During *kharif* 1992, kits of only two cultivars, composite Ageti 76 and hybrid G 11, were distributed.

The allocated number of minikits was the least for maize (60%) in 1991 but agreement between targeted and allocation was, in general, very satisfactory (Table 7.4).

Rice. Allocation of special minikits for rice started in *kharif* 1993. All varieties distributed were meant for transplanting under irrigated conditions. None were recent releases and no kits of upland rice varieties were included. Two varieties, Ratna and Jaya, were more than 20 years old.

Chickpea. New varieties of chickpea recommended for the state have been regularly included in the mini-kit programme for Rajasthan. However, varieties that are 10 to more than 30 years old such as C 235, Dahod Yellow, and Pusa 209 continued to be included (Table 7.5).

Data from the minikit trials for *rabi* 1992-93 (Table 7.6) show that Dahod Yellow was the highest yielder followed by the new varieties BG 267 and BG 256, while the lowest yielder was GNG 146. Although the state released variety RSG 44 was notified in 1991, it was not included in the programme until 1993-94, and then only a few kits were made available, probably because of a shortage of seed.

Table 7.4 The number of special minikits targeted and actually distributed in different districts of Rajasthan during *kharif* 1991-1993

Season /Crop	Variety	Year of release	Target	Number Distributed
<i>kharif</i> 1991				
Pearl millet	MH 179	1986	24000	22184
	MH 169	1987	8000	3717
	HHB 67	1990	8000	9648
	ICTP 8203	1988	8000	7725
	Total		48000	43274
Maize	Ageti 76	1982	1008	1008
	D 103	1982	1008	745
	Navjot	1982	1485	135
	Parbhat	1988	1485	-
	Partap	1983	3019	3008
	Total		8000	4761
<i>kharif</i> 1992				
Pearl millet	HHB 67	1990	15000	13498
	ICTP 8203	1988	5400	5400
	Total		20400	18898
Maize	Ageti 76	1982	3000	1980
	G 11	1988	6500	6244
	Total		9500	8224
Sorghum	SPH 388	-	1250	1250
<i>kharif</i> 1993				
Pearl millet	HHB 67	1990	5323	5221
	ICTP 8203	1988	12110	12373
	HHB 60	1988	50	50
	Total		17483	17644
Rice†	IET 11819	-	475	475
	IET 11581	-	40	40
	Ratna	1970	112	112
	Jaya	1968	115	115
	Total		877	877

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†No minikits were received for rice in 1990, 1991 or 1992.

Results of a distribution of special research minikits in 1993-94 indicates that three varieties included are not recommended for Rajasthan and while the state release RSG 44 was not formally included it appears in the results for two districts (Bharatpur and Sawai Madhopur) as it must have been included by officials taking individual initiative who had seeds available (Table 7.7).

Table 7.5 Number of minikits distributed for various chickpea varieties from 1990-91 to 1993-94 in Rajasthan.

Variety	Year of Release	No. of mini-kits distributed			
		1990-91	1991-92	1992-93	1993-94
GNG 146	1984	1500	3100	1708	-
Pusa 209	1980	2755	2899	5615	-
Dahod Yellow	1960	1807	3198	3458	3956
Pusa 212	1982	2884	5250	-	-
RSG 2	1982	-	300	-	-
BG 256	1985	-	-	150	-
BG 267	1987	-	-	799	1000
RSG 44	1991	-	-	-	491
C 235	1960	-	-	-	2128
Total		8946	14747	11630	7575

Table 7.6 Chickpea minikits distributed and their results in Rajasthan during 1992-93.

Variety	Year of release	No. of minikits allotted	No. of minikits conducted	No. of results obtained	Yield (kg ha ⁻¹)
					Mean
P 209	1980	5615	5615	5015	910
Dahod Yellow	1960	3450	3458	1728	1119
GNG 146	1984	1710	1708	1050	670
BG 267	1987	800	799	399	929
BG 256	1985	150	85	60	1000
Total		11670	11565	8282	

Table 7.7 Number of special research minikits of chickpea varieties distributed in different districts of Rajasthan in 1993-94

Variety	Year of release	No. of packs†
Avrodhi‡	1982	550
PDG 84-10‡		888
P 212	1982	3000
Dahod Yellow	1960	3000
P 256‡	1985	1000
P 267	1987	2500
RSG 44	1991	-
C 235	1960	-

† 7 kg packs (each for 0.1 ha)

‡ varieties not recommended in Rajasthan

Conclusion

Are minikits an effective tool in popularising a range of promising new varieties with farmers? The answer would appear to be that they would be having a limited impact for several reasons:

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- **Age of cultivars.** The age of the cultivars tested in the minikits varied by crop. In maize, most of the varieties were eight to nine years old, in rice two were more than twenty years old, and in chickpea, even if 30-year-old Dahod Yellow and C 235 are excluded, many varieties tested were 8 to 9 years old.
- **Number of varieties.** The number of varieties tested in the minikits over several years was low, and in some crops such as upland rice no varieties were tested. Only in chickpea was an adequate range of varieties tested.
- **Number of minikits.** Apart from pearl millet the number of minikits is very low in proportion to the area of the crop and the number of farmers. Even in pearl millet, which had the greatest number of minikits, most of the minikits were hybrids MH 179 and HHB 67 that were under commercial production in the private sector. ICTP 8203, a composite variety, was tested in reasonably large numbers, but this effort was not supported by its official release.

Adaptive trials

There are seven Adaptive Trial Centres (ATCs) in Rajasthan at: Tabiji Farm (Ajmer); Sumerpur Farm (Pali); Chittorgarh; Sewar Farm (Bharatpur); Karanpur Farm (Ganganagar); Rampura Farm (Jodhpur); and Chhatarpura Farm (Bundi). Varieties recommended for release by AICCIP and by the university are tested at ATC farms in the state, and at farmers' fields. The data generated are included in release proposals presented to the SSSC. By conducting trials in farmers' fields, farmers are exposed to new cultivars and this helps popularisation.

In pearl millet, the adaptive trials test hybrids developed by the public as well as the private sectors. The private sector hybrids, HLBH 10, VBH 4, MH 36, HYB 7701 and HYB 7508 were included when they were released, and hybrids such as GHB 30, MH 36, MHB 60, HHB 67 were included even before their release. During 1993, all hybrids and varieties in adaptive trials were from the public sector (Table 7.8) and ICRISAT. Of all the crops studied, pearl millet had the youngest entries in the ATCs.

Table 7.8 Adaptive trials conducted at Adaptive Trials Centres (ATC) in four crops in Rajasthan during 1993 (number of ATCs where available is given in parenthesis).

Crop	Range of yield (t ha ⁻¹)	Varieties tested
Pearl millet	0.7-2.1	MH 179(4), RHB 30(3), HHB 67(4), MP 171(2), Pusa 23(1), ICTP 8203(2), HHB 68(1), CZ-IC-922(1), RCB-IC 911(1), RCB-IC 924(1)
Maize	1.2-4.2	<i>Early group:</i> EV 55(1), EV 52(1), EV 34(2), Kiran, D 765(1), Surya(1), W 101(1), W 148(1), Navjot(2), Ageti 76(2), Mahi Kanchan(2) at ATC Chittorgarh and Chattarpur (Bundi) <i>Late group:</i> Ganga 2(1), Ganaga 11(1), W 126 [Mahi Dhawal(1)], W 148(1), Navjot(1). At ATC Chittorgarh and Chattarpur (Bundi).
Upland rice	0.8-1.5	IET 7566, IET 8681, RRU 664, RRU 5, Sutar, Pusa-2-21, IET 7979, RRU 665, Pathariya. At ATCs in Zone IVB.
Chickpea (<i>desi</i>)	0.8-2.3	RSG 44(2), Dahod Yellow(3), Ujjain 21(2), GNS 146(1), GNG 642(1), GNG 663(1), GNG 669(1), GNG 158(1), GNG 518(1), GNG 545(1), GNG 543(1), GNG 496(1), C 30(1), BKG 60(1), BKG 51(1). At ATCs in rainfed conditions.
Chickpea (<i>kabuli</i>)	0.5-1.5	GNG 149(1), L 550(2), Phule G 5(1), ICC 32(1), GNG 146(1)

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There are two ATCs in the maize growing area, at Chhatarpura (Bundi) and Chittorgarh. Trial data for the period 1988-1993 (data not shown) shows that only a very small number of genotypes from among the recommended cultivars were included, particularly among the composites. While composites Kiran, Surya, and D 765 were actually released during 1988, they were not included until 1993 (Table 7.8).

In rice, different genotypes were used in different years, with the exception of IET-8681, which appeared to be promising and was tested for at least 3 years. Trials in 1993 conducted at ATC farms in zone IVB were confined to upland rice only (Table 7.8). However, in 1992 trials were conducted on lowland rice also (not shown).

In chickpea, in trials conducted under irrigated and un-irrigated conditions at various ATCs from 1988-93, there was a fair representation of improved cultivars recommended by the All India workshop. Old varieties such as C 235 and Dahod Yellow were also retained (Table 7.8), probably for comparison vis-à-vis upcoming and newly identified cultivars, and to obtain preferences from farmers. However, Pusa 244, which was identified for Rajasthan during 1985, was not included in the trials programme; and old variety Phule G 5 was included in 1993 trials, even though it is not recommended for Rajasthan.

Block demonstrations

Block Demonstrations are conducted by the Department of Agriculture (GOR) in villages for cereals, oilseeds and pulses. Large plots ranging from 10-50 ha are chosen, and the Rajasthan State Seeds Corporation takes advantage of these demonstrations to grow foundation seed and thereby produce supplies of certified seed. As well as popularising a cultivar, the demonstrations also disseminate the complete production technology. However, the large size of the plots means that the number of block demonstrations is limited.

First-line demonstrations

The RAU has a Directorate of Extension Education which popularise the new technology through demonstrations conducted by KVKs who also conduct minikits through the Department of Agriculture, GOR. The demonstrations of KVKs are designed to transfer technology recommended by ZREAC meetings for the zone. Field days are held at farmers' fields. KVKs also conduct first-line demonstrations for oil seeds and pulses (Tables 7.9 and 7.10).

As is the case with the minikits, many of the chickpea cultivars are very old and all are at least seven years old. This is in contrast to the chickpea trials conducted in Rajasthan by KRIBHCO using a participatory approach (Chapter 12).

Table 7.9 Summary data on first-line demonstrations for mustard and chickpea conducted on farmers' fields in *rabi* 1992-93 in Rajasthan.

Crop	Variety	Area (ha)	No. of farmer participants	Yield (t ha ⁻¹)		Increase (%)
				Demo	Local	
Mustard	T-59, RH 30, P. Bold	235	594	1.34	1.05	29
Chickpea	Dahod Yellow, GNG 146, RSG 44, C 235	195	529	1.56	0.97	62

Table 7.10 Number of chickpea demonstrations conducted by KVKs during 1992-93 in Rajasthan.

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No. of KVKs/districts	Variety	Year of release	No. of demonstrations
13 (irrigated)	C 235	1960	162
	GNG 146	1984	20
	Dahod Yellow	1960	125
	BG 256	1985	4
2 (rainfed)	H 208	1977	10
	C 235	1960	34

Farmers' fairs (*Kisan melas*)

The main university research stations, and their sub-stations, hold farmers' fairs twice a year, once during *kharif* and once during *rabi*. All the released genotypes and genotypes that are in the pipe line are shown to farmers, and their attributes are pointed out. During 1992-93, 13 farmers' fairs and 20 exhibitions were held in different districts of Rajasthan that attracted 22,780 and 9,400 farmers, respectively (Table 7.11). Fairs are also organised by some KVKs at their farms.

Front-line demonstrations

Front-line demonstrations for oilseeds and pulses are conducted at farmers' fields by research station scientists in contrast to first-line demonstrations by extension workers. As well as being exposed to the new cultivar, farmers are also given information about protection and production technology. ICAR sanctioned demonstrations for maize, the first one being held in *kharif* 1994.

The role of NGOs

There are four organisations engaged in activities concerning assessment of farmers' preferences for released cultivars as compared to local pearl millet cultivars:

- Social and Research Centre, Ajmer;
- Indo-Swiss Goat Development and Fodder Production Project, Ajmer;
- URMUL Trust, Bikaner, and
- Society for Uplifting Rural Economy (SURE), Barmer.

These NGOs, in collaboration with ICRISAT, have participated in the evaluation of the released hybrid HHB 67, and varieties RCB-IC 911 and ICMV 155 of pearl millet in four villages: Menwa (Ajmer district); Udaipur; Aagolai (Jodhpur district); and Khichiyasar (Bikaner district) during 1993. Some of this research is more extensively described in Chapter 11. In addition, NGOs are involved in a GO/NGO forum in Udaipur (see Chapter 14)

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Table 7.11 Farmers' fairs organised in different districts in Rajasthan during 1992-93.

District	Farmers' fairs		Exhibitions	
	No.	Participants	No.	Participants
Sri Ganganagar	1	-	2	-
Kotputli	1	1000	3	-
Borwat (Banswara)	1	2650	3	-
Bhilwara	1	5000	1	-
Kumher (Bharatpur)	1	-	2	-
Ajmer	1	700	-	-
Fatehpur-Shekhawati	-	-	-	-
Chittorgarh	1	1000	-	-
Jaisalmer	-	-	-	-
Keshwana (Jalore)	2	6500	2	6500
Nagaur	-	-	-	-
Dungarpur	1	4370	2	1000
Sawai Madhopur	1	-	1	-
Beechwal (Bikaner)	1	1110	3	1400
Jhunjhunu	-	-	-	-
Sirohi	1	450	1	500

Seed producers

There are five producers of foundation and certified seed:

- **The Rajasthan State Seed Corporation (RSSC).** The corporation was established in 1978 under NSP (National Seeds Project) Phase II, and the functions of the Seed Production Scheme of GOR were transferred to it. RSSC is the only public sector agency in the state engaged in seed production of foundation and certified seed of all major crops. As well as producing seed at its own farms, a major part of its production is through contract growing by individual seed growers and producers.
- **National Seeds Corporation (NSC).** NSC was a significant seed producer in Rajasthan until the early 1980s, but since then its programme has been considerably reduced.
- **State Farms Corporation of India (SFCI).** SFCI is a fairly large seed producer. It has three Central State Farms located in Ganganagar district, which produce foundation and certified seed of varieties of cotton, wheat and chickpea.
- **Rajasthan Agricultural University (RAU).** The university is mainly concerned with the production of breeder and foundation seed.
- **Private Seed Companies.** The private sector is a major seed producer. Companies mainly produce foundation and certified seed of cotton, wheat, chickpea, mustard and groundnut.

Rajasthan State Seed Certification Agency (RSSCA)

Until 1978, NSC was responsible for seed certification in the state. The Rajasthan State Seed Certification Agency (RSSCA) was then set up and took over the task. It's governing board, the members of which serve for two years, comprises:

- Agricultural Production Secretary, GOR - Chairman;
- Director of Agriculture, GOR;
- Director of Horticulture, GOR;
- Deputy Secretary (Finance), GOR;

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- Director Research, RAU;
- Two Senior Scientists (Research), RAU;
- Three representatives of the seed trade;
- A farmers' representative, and
- Director, RSSCA.

The representatives of RSSCA inspect plots producing foundation and certified seed that are offered for certification, and supervise processing and labelling of seed at 77 registered processing plants, spread over the state.

Breeder seed

RAU multiplies the breeder seed of cultivars developed by the university itself and also cultivars from other states, for example on the basis of requisitions in BSP-1 (Breeder Seed Production-1) sent by the ICAR. The GOI allocates breeder seed to the indenting institutes on the basis of targeted production figures. Production of breeder seed of parental material of hybrids is not successful in Rajasthan and is not attempted. However, sufficient quantities of breeder seed are produced of varieties of cotton, barley, wheat and pulses, corresponding to the requirements of the state. Production of seed of groundnut and soybean varieties is on a very limited scale, and the balance is made up by supplies from other universities, who produce seed in response to the demand indicated in BSP-1 and supply according to the GOI demand-led allocations of the produced seed.

Foundation seed

SFCI is the major producer of foundation seed, followed by the private companies. RSSC, RAU and NSC have very small programmes (Fig. 7.2), especially during *kharif*. However, sufficient quantities of foundation seed are produced in *rabi*.

During 1990-93 there was virtually no production of parental lines of hybrids of pearl millet and maize, and Pusa 2-21 was the only upland rice variety produced, and this was probably meant for other states. Foundation seed of varieties of groundnut, kidney beans, cluster beans and sesame was produced in far smaller quantities than was required by Rajasthan. However, sufficient quantities of foundation seed of cotton, green gram, black gram, soybean, wheat, mustard, chickpea and barley were produced.

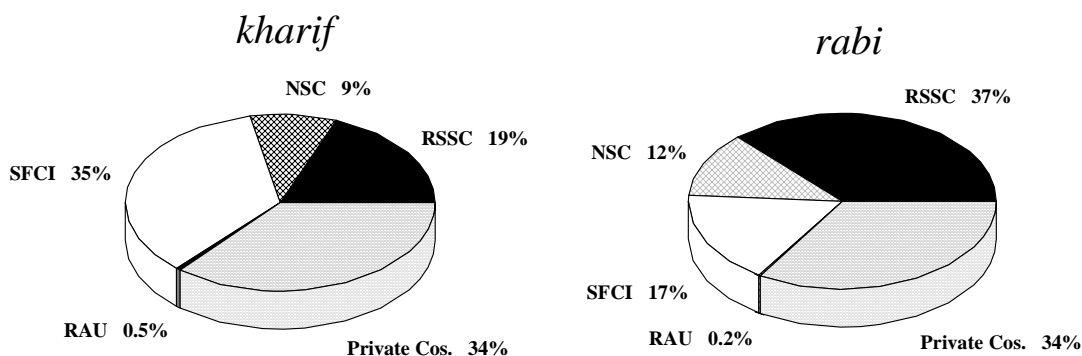


Figure 7.2 Percent share of various agencies in the total production of foundation and certified seed during *kharif* and *rabi* seasons of 1992-93. NSC = National Seeds Corporation; RAU =

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Rajasthan Agricultural University; RSSC = Rajasthan State Seed Corporation; SCFI = State Farms Corporation of India.

Certified seed

RSSC and private agencies are responsible for about 72% of certified seed production, having about an equal share. Over *kharif* and *rabi* 1992-93, SCFI's contribution was 17% (Fig. 7.2) and it varied from 15-59% from 1990-91 to 1992-93. NSC and RAU make up the rest. Certified seed of wheat, barley and cotton is produced in sufficient quantity in the state, but there is a shortfall in pulses and oilseeds.

Dissemination of varietal information

Responsibility for informing seed producers, extension officers and farmers about a variety released in the state lies mainly with the Department of Agriculture (GOR) and RAU. The dissemination procedure for nationally released cultivars is the same as that for the state released cultivars, but begins only after a cultivar is recommended for release in the state.

RSSC receives a copy of the notification document from the Director of Agriculture and informs private seed producers and other contract growers about the new variety through training camps held twice a year, one before the beginning of *kharif* and the other before the beginning of *rabi*. These camps inform seed producers not only about new cultivars but also about technologies for foundation and certified seed production. Private seed producers also get to know about newly released cultivars through contacts with extension workers and research scientists.

Distribution and sale of seeds

Sale of seed in Rajasthan is governed by many factors, including the timing of the monsoon, duration and amount of rainfall, availability of seed and, to some extent, the price of seed. Because of variable rainfall, there are significant variations in the sale of seed from year to year. Demand increases if the rains are good, timely and well spread over the monsoon season. Good rains help recharge the groundwater, which increases the area under irrigated cultivation during *rabi* season, and, consequently the demand for seed.

The Director of Agriculture receives requests for seed from the district level about a year in advance and assesses the state's requirements. During and after the sale, weekly and then final distribution reports are sent in by the districts.

The total amount of certified seed sold is about 1,250-1,500 t. The remainder is TL (Truthfully Labelled) seed of notified or unnotified cultivars, including the so-called research hybrids sold by the private companies. The proportion of nationally released cultivars to those of state released cultivars is 80:20.

Wheat, mustard and cotton account for 70-75% of certified seed sold. The rest is made up of seed of hybrids of pearl millet, sorghum, maize, groundnut and pulses. Hybrids of pearl millet, sorghum and maize account for only a low percentage, because uncertainty of rainfall makes farmers sceptical about the success of the harvest during *kharif*. Farmers growing under rainfed conditions also find certified seed difficult to afford.

There are two important seed distributing channels in Rajasthan, the RSSC and the private sector. The RSSC is able to make 33-50% of the state's seed sales, and private agencies 50-67%. During 1993-94, 49% of the seed was distributed by RSSC, 48% by private sector and 3% by NSC.

The RSSC markets seed through a three-tier dealer network:

- **The co-operative sector.** There are 131 *Krya Vikrya Sahakari Samiti* (KVSS) and 175 *Gram Sewa Sahakari Samiti* (GSSS) centres in the state. Indents are placed with RSSC well before the

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- start of both *kharif* and *rabi*, and an allotment, and supplies, are made to them in proportion to total estimated, and actual, availability.
- **Private dealers.** 24 wholesalers and 1,175 private dealers are registered as agents for RSSC. They pay a deposit to reserve an allocation of seed. Registration is renewed annually. Each company has its own dealers for selling its products.
- **Institutional.** RSSC uses 12 processing plants as sales depots. It has also started opening make-shift seasonal depots, with 17 opened to date.

Occasionally the co-operative sector gets preference over private dealers in the allotment of seed by RSSC when there is a shortage of seed, but in normal years allocation is in accordance with the requirements of the different sectors.

Some NGOs sell seed on a very limited scale in Ajmer, Bikaner, Barmer and Phalodi, but no data are available showing their contribution to sales in the state. Five of Rajasthan's large number of registered NGOs have KVKs, but none of them are engaged in seed multiplication of improved varieties for distribution to farmers. The five are:

- **Vidya Bhawan Society, Badgoan, Udaipur.** The society is mainly involved in education and training. Its agricultural activities are confined to buying small quantities of seed and selling it to farmers for demonstration purposes.
- **Society for Uplifting Rural Economy, Barmer.** Predominately concerned with developing desert areas, the society's main activities are aimed at livestock - cattle, sheep, goat and camel - improvement. It buys small quantities of seeds of pearl millet, cluster beans, kidney beans and other pulses from an Agriculture Research Station, and from RSSC, for selling to farmers.
- **Gandhi Vidhya Mandir, Sardarshahar (Churu).** Most of its work is in the area of education.
- **Pragati Trust, Chomu (Jaipur).** The institution has some agricultural activities, such as advising farmers about the use of improved cultivars and plant protection measures.
- **Banasthali Vidhya Peeth, Banasthali (Tonk).** This is a newly formed NGO concerned mostly with general education.

Conclusions

Identification and release system

Sometimes, adequate data cannot be generated due to lack of personnel and infrastructure facilities, including locations for conducting varietal tests.

- For maize, no defined testing sites have been specified by RAU, which is working on maize at Bhilwara, Kota, Jhalawar and Ajmer but has no specified staff and budget provisions for conducting trials. In important pearl millet growing districts such as Barmer, Churu, Jhunjhunu and Jaisalmer, adequate testing locations are not available. In some other districts where testing locations are available, the necessary staff or funds are unavailable.
- Frequent relocation of senior breeders results in inadequate generation of data from varietal trials. For example, the headquarters of All India Coordinated Pulses Improvement Project (AICPIP) was shifted from the Agriculture Research Station, Durgapura, to the Agricultural Research Station, Navgaon in 1984. Frequent changes in the post of senior pulse breeder for this programme affected the generation of data for the chickpea cultivar RSG 44. The cultivar was identified for release in the north-western plain zone in 1984 by the All India Coordinated Pulses Improvement Project Workshop, but the data of on-farm and ATC trials were not adequate for presenting to the SVEC and the SSSC. As a result, it was approved for release by the SSSC in 1989, but was not notified until 1991. Similarly, the pearl millet hybrid RHB 30 was identified for release by the SVEC in 1991, but was not actually released until 1994.

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- Climatic factors, such as droughts or excessive rains, cause failure of trials. Rajasthan's widely varying climate makes it difficult to carry out successful trials and collect good data each year, particularly for rainfed crops like maize and pearl millet.
- An adequate quantity of seed of promising cultivars, particularly pearl millet and maize hybrids, is not available. Cancellation of trials due to seed shortage can add years to the testing of a cultivar. Identification and release can also be held up when seed is unavailable for on-farm demonstrations, ATC trials and pre-release minikits.

The procedures could be made more flexible and the time taken for release reduced:

- In the procedures for testing at the national level, the testing of a cultivar in AVTs could be reduced from two years to one year. Recommendation, based on one year testing in IET and one year testing in AVT under the coordinated projects, could be sent to the state(s) so that minikits, ATC trials and on-farm trials could be conducted. This would save one year in its release for the state(s).
- There is some flexibility in the system, but it should be more responsive to the needs of farmers. For example:
 - The pearl millet composite ICTP 8203 has not been released for the state, but is very popular and is grown in arid and semi-arid areas of Rajasthan, because of its capacity to withstand terminal drought.
 - Cotton HS 846 is very popular in the Sri Ganganagar area, where around 30 t of seed is distributed over an estimated 20,000 hectares. Though not recommended by the state, this cultivar is being brought in by farmers from adjoining states, such as Punjab and Haryana.
 - Examples of cultivars that have become popular with farmers, without first going through varietal testing and release in the state, include pearl millet hybrid BJ 104, wheat Lok 1, chickpea Dahod Yellow, groundnut JL 24 and GG 2, and mustard Pusa Bold.

Popularisation with farmers

- The adoption rate for new cultivars is often slow, for a number of reasons:
 - They are not promoted for several years after their release.
 - They are not promoted in the appropriate micro-farming areas.
 - They are unsuitable for drier regions because they are late maturing, for example, maize composites Vijay, Arun and Shweta and pearl millet ICMV 155.
 - Non-availability of seeds, for example, in the case of sorghum varieties SPV 346, SPV 245, and SPV 96.
- Despite the large extension networks, exposure of cultivars to farmers needs considerable improvement. Absence of exposure to newly released cultivars is reflected in an absence of demand for new varieties. This ultimately affects the seed production programme, which in turn means that seed is not available for exposure on a mass scale. For example, nationally or other state released cultivars such as Aakashi, Kaveri, MW 10, and Kalinga III have not been adopted due to non-exposure to farmers. Scientists and extension workers need to monitor closely the choice of cultivars for particular regions.
- Some crops and areas are entirely neglected. For example, there are no minikits, demonstrations and ATC trials for upland rice for tribal hilly areas.

Seed production, certification and dissemination

- Timely inspections may not be conducted by RSSCA, either due to distance or staff shortages.

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- Operations such as threshing and packing, which take place simultaneously at different locations, are not being attended to, due to staff shortages. The chances of admixtures are enormous.
- Yield estimates, which have to appear in the final inspection report by RSSCA, may not be correct if estimated by new comers even though this statistic is very important. The produce accepted by the processing plant should not differ from the estimate by more than 10%. When there is an overestimate, too little genuine seed is accepted, whereas if the quantity of genuine seed produced is less than the estimate, an admixture may be resorted to.
- Foundation seed plots should be inspected during flowering, which is generally not done, causing deterioration in the quality of foundation seed.
- The problem of foundation seed and certified seed production of newly released cultivars needs to be addressed so that sufficient seed is available for the popularisation programme. Good commercial production is a high priority because the adoption of new cultivars revolves around the availability of foundation seed and certified seed. On the whole, the system works better for varieties of self-pollinated crops and cotton: as soon as sufficient breeder seed has been supplied by the breeder, the cultivar quickly enters the production chain, and future production then reflects the reaction of farmers to it. But there are impediments to the satisfactory functioning of the system for hybrids of pearl millet and maize, making it difficult for farmers to buy foundation seed of parents, grow the hybrids and get assured returns.