El Nino Effects and Strategies: Varietal and Crop Replacement Strategies under delayed monsoon conditions

Punjab

State	Major Crops	Area (ha)	Varieties		Crop replacement strategy: In case the monsoon gets delayed and normal sowing is not possible, then the crop/variety
			Normal conditions	Delayed conditions	
	Paddy	3243300	PR 131, PR 128, PR 130, PR 114, Pusa 44, CR 212, Pusa Basmati 1718, Pusa Basmati 1847	PR 126, Pusa Basmati 1509	Sowing is almost complete (90%) across the state. Transplanting of basmati varieties and PR 126 after fodder harvesting of silage maize is pending. In case normal sowing is not possible kharif moong variety ML 818, ML 2056, Sesame variety Punjab Til No.2 and RT 346, Bajra variety PCB 167, PCB 166, PCB 165 can be grown till end of July
	Cotton	80,000	Private Bt cotton hybrids (viz; RCH 921, Diggaj etc.) and Desi cotton PBD 88	-	100% sowing is already complete.
	Maize	86100	PMH 17, PMH 14 and other private hybrids	PMH 17, PMH 14	90% sowing has already been completed. IN case of delayed monsoon where timely sowing is not possible Kharif moong variety ML 818, ML 2056, Sesame variety Punjab Til No.2 and RT 346, Bajra variety PCB 167, PCB 166, PCB 165 can be grown till end of July
	Kharif Moong	3100	Private varieties or own seed	ML 818 and ML 2056	Kharif Moong varieties ML 818, ML 2056. Sowing can be done till end July
	Fruit Crops				
	Kinnow	1581	Kinnow, Daisy, PAU Kinnow 1	All these varieties can be planted in delayed conditions also with change in orchard management practices in case of delayed monsoon	In long term drought tolerant or less water requiring rootstock can be used and crop diversification with less water requiring or drought tolerant fruit crops such as Amla, Guava, Pear etc. can be done especially in areas which are more susceptible for losses due to change in monsoon
	Sweet Orange	86	Mausami, Jaffa, Blood Red, Balencia		
	Lime Lemon	49	Kagazi, PAU Baramasi Lemon, Punjab Galgal, Grape Fruit, Star Rubby, Red Flush		

	Mango	32	Dashehari, Langra, Amrapali, GN 19,		
	Peach	74	Shan e Punjab, Early Grand, Florida Prince, Partap and Parbhat		
	Pear	24	Pathar Nakh, Punjab Nakh, Punjab Beauty, Nijisseiki,		
	Plum	8	Staluj Purple, Kala Amritsari		
	Amla	19	Balwant, Kanchan, Neelam		
	Vegetable Crops				
	Onion	11526	Private hybrids	Agri Found Dark Red (ADFR)	Can be sown by end of August
	Tomato	11298	Private hybrids	Punjab Varkha bahar 4, Punjab Varkha Bahar 1 and 2	Can be transplanted till end of August
	Brinjal	7882	PAU hybrids and Private Hybrids	PBH 3, PBH 6, PBH 41, Punjab Raunak	Transplanting can be done from July end to Mid August
	Okra	6598	PAU varieties and various private hybrids	Punjab Lalima, Punjab Suhawani, PB 8	Sowing can be done in June July
	Cauliflower	27875	Early Kunwari	Punjab Maghari	For early season crop varieties transplanting time is June to July and for main season August to Mid September
	Vine crops	29634	PAU varieties and Private hybrids	Punjab Barkat, Punjab Komal, Punjab Bahar, Punjab Nikhar, Punjab Nawab and other varieties of bottle gourd, sponge gourd, bitter gourd, and pumpkin	Vine crops can be sown in June and July

Himachal Pradesh

State	Major Crops	Area (ha)	Varieties		Crop replacement strategy: In case the monsoon gets delayed and normal sowing is not possible, then the crop/variety
			Normal conditions	Delayed conditions	
Himachal Pradesh	Maize	295000	Palam Sankar Makka 1 &2, Rashi 3591, Him Palam Makka1, Sri Sri 5455, Proagro (4642 & 4640), Double Dekalb, Bisco 855, KH-717, and HQPM-1, PG 2414	Bajaura Makka	Sowing is almost complete across the state
	Paddy	88000	Him Palam Dhan 3 & 4, Palam Lal Dhan 1, US 312, Tata 834, Arize 6129, Savanah Vijeta 100, Rasi 4007	Palam Basmati 1, HPR 2612, Advanata 807, Advata 8010, Tata 8101	About 60- 65 % sowing is already complete and remaining will be completed in 7 days as monsoon rains are received regularly. Black gram can be used as contingent crop in case there is any area left unsown due to delayed monsoon
	Pulses (Black gram)	32000	UG 218, T-9, Pant U 19	Him Mash 1	Sowing is usually done during second fortnight of July, hence it has started
	Soybean	10750	Him Palam Hara Soya 1 (Himso 1685), Pant Soybean 25 (PS 1556), and Palam Soya	Him Soya	Sowing is almost complete across the state
	Oilseeds (Rabi-Sarson)	8700	Him Sarson 1, GSC 7, HPGS 2, THPM 1	Gobhi sarson-Neelam (HPM 3),	-
	Fruit Crops				
	Apple	116.33	Royal Delicious, Red Delicious, Rich-a-Red, Jeromine, Golden Delicious, strains of Gala, Fuji, Super Chief, Scarlet Spur-II	All these varieties can be planted in delayed conditions also with change in orchard management practices in case of delayed monsoon	In long term drought tolerant or less water requiring rootstock can be used and crop diversification with less water requiring or drought tolerant fruit crops such as pomegranate, ber etc. can be done especially in Sub tropical areas which are more susceptible for losses due to change in monsoon
	Mango	42.50	Dashehari, Langra, Chausa, Amrapali, Totapuri, Safeda, Sindhu		
	Citrus	26.65	Kinnow, Malta, Mosambi, Kagzi Lime, Galgal		

	Peach	4.75	July Elberta, Flordasun, Shan-e-Punjab, Early Grande, Pratap		
	Plum	9.09	Santa Rosa, Red Beaut, Mariposa Frontier, Black Amber, Friar, Angeleno		
	Apricot	3.17	New Castle, Charmagz, Kaisha, Halman		
	Pear	6.28	Bartlett strains, Kiefer, Packham		
	Guava	3.22	Allahbad Safeda, Sardar Guava, Lalit, Shweta		
	Litchi	6.96	Dehradun, Rose Scented, Culcuttia, Shahi		
	Vegetable Crops				
	Pea	22855	PB-89, Azad P-1, Palam Priya, Lincoln	Palam Triloki, Arkel, GS-10, Matar Ageta-6, Matar Ageta-7, Pusa Prabhat	Garlic
	Tomato	13750	Solan Lalima, Him Pragati, Him Palam Tomato Hybrid-2	Solan Vajr, Palam Pink, Him Palam Tomato-1 and Him Palam Tomato-2	French bean, millets
	Bell pepper	2332	California Wonder, Solan Bharpur	Solan Shakti, Indra, Solan Bharpur	French Bean, Millets
	French bean	4276	Lakshmi, Contender	Arka Komal, Pusa Parvati, Falguni	Millets
	Okra	3941	Pusa Sawani, P-8	Palam Komal, Pusa A-4, Arka Anamika, P-8	Millets, French bean
	Cauliflower	5448	Early Kunwari and Pusa Deepali	Pusa Him jyoti, Pusa Early Synthetic,Pant Gobhi-2 and Pant Gobhi-3	Garlic

Jammu & Kashmir

State	Major Crops	Area (ha)	Varieties		Crop replacement strategy: In case the monsoon gets delayed and normal sowing is not possible, then the crop/variety
			Normal conditions	Delayed conditions	
Jammu & Kashmir (Kashmir Division)	Rice	~1,40,000	Shalimar Rice-4 , Shalimar Sugandh-1 (low to mid altitudes), Shalimar Rice-5, Shalimar Rice-9-high altitudes),	Shalimar Rice-3 for low to mid altitude & Shalimar Rice-8 for mid to high altitude	• Promote short-duration and comparatively drought-tolerant varieties such as **Shalimar Rice-3**and **Shalimar Rice-8** where transplanting is delayed. • In low and mid-altitude irrigated areas, adopt staggered nursery raising and younger seedlings for delayed transplanting. • Where rainfall deficit persists and irrigation is unavailable, shift paddy area to maize, pulses (rajmash, moong) and fodder crops depending upon the sowing window. • Promote Direct Seeded Rice (DSR) wherever feasible, laser land levelling, field bunding and alternate wetting and drying (AWD) to improve water-use efficiency. • Prioritize irrigation for nursery establishment and critical crop stages wherever limited water resources are available.
	Maize	~1,10,000	Shalimar Maize Composite-4 (SMC-4), SMC-7, SMC-8, KG-1, KG-2, Shalimar Maize Hybrid-5 (SMH-1)	SMC-4, SMC-7, KG-2, SMH-1	• Promote short-duration maize composites such as **SMC-4**, **SMC-7**, **SMC-8**, **KG-2** and hybrids like **SMH-5** under delayed sowing situations. • Maize should serve as the primary contingency crop where paddy transplanting is not possible. • Adopt ridge-furrow planting, conservation tillage, mulching and seed treatment to conserve soil moisture. • Maintain optimum plant population through gap filling. • Provide life-saving irrigation at tasseling and grain-filling stages wherever possible.
	Fruit crop				
	Apple	~1,70,000	Traditional orchards dominated by **Red Delicious** and Delicious	Existing orchards (no varietal replacement)	• Apple being a perennial crop, crop replacement is not feasible under delayed monsoon conditions. • In traditional rainfed orchards dominated by

			group strains (predominantly rainfed); High-density orchards (>5,000 ha) dominated by **Gala** on clonal rootstocks under drip irrigation		**Red Delicious**, conserve soil moisture through mulching, basin management, orchard floor vegetation management and rainwater harvesting. • Undertake timely thinning of fruits where required to reduce moisture stress. • Provide life-saving irrigation wherever available. • In high-density orchards dominated by **Gala**, optimize drip irrigation scheduling, fertigation and mulching to improve water-use efficiency. • Promote farm ponds and rainwater harvesting structures for supplemental irrigation under prolonged dry spells. • Avoid excessive nitrogen application during drought periods and undertake regular pest and disease surveillance under moisture stress conditions.
Jammu & Kashmir (Jammu Division)	Rice	**260000**	B 370/Ranbir basmati/B 564/K-39	Jaya	• Adopt short-duration and drought-tolerant varieties such as Shalimar Rice-4, Shalimar Rice-5, Jammu Basmati-118 and Jammu Basmati-123. • Paddy should be diversified to maize, moong, mash and other pulse crops in areas facing severe rain fall deficit and irrigation shortages. • If paddy establishment fails due to prolonged drought, farmers should shift to maize and pulse-based cropping systems depending upon available soil moisture. • Direct Seeded Rice (DSR), laser land levelling, field bunding and seed priming should be promoted to improve water-use efficiency.
	Maize	**310000**	GS-2, Mansar, Vijay, C-5, C-8/ Kanchan/DD/Bioseed	SMC-4, SMC-7, PHM-12	• Promote drought-tolerant and short-duration varieties such as SMC-4, SMC-7, PHM-12 and Jammu Maize Composite-3. •Maize should be encouraged as the primary contingency crop where paddy transplanting is delayed or fails due to El Niño-induced drought conditions. • Ridge-furrow planting, contour farming, mulching, conservation tillage and seed treatment should be adopted to conserve soil moisture.

					• Gap filling should be carried out to maintain optimum plant population. • Life-saving irrigation should be provided at tussling and grain filling stages wherever water is available.
	Moong/Mash	250000	Pant U-19/Uttara (IPU-94-1/Pant U-31 Pant Mung-6/PDM 54 (Moti)/Shalimar Moong-1/SML 668	JAUM-0936 /Pant U-19	Promote varieties such as Shalimar Moong-1, Shalimar Moong-2, JAUM-0936 and Pant U-19. •Moong and mash should be promoted as contingency crops where paddy establishment fails or water availability is inadequate for rice cultivation.

Uttarakhand

State	Major Crops	Area (ha)	Varieties		Crop replacement strategy: In case the monsoon gets delayed and normal sowing is not possible, then the crop/variety
			Normal conditions	Delayed conditions	
Uttarakhand	Maize	3574	Pant Sankul Makka 1,Tarun, Navin, Pant Shankar makka 6; Vivek Sankul Makka 11,31,35,37 Proagro (4642 & 4640), Kanchan (Safed)	Kanchan,Surya Pant Sankar makka-1	Sowing is almost complete across the state
	Finger millet	1251	VLM-324, VLM-149,VL 352,VL 382	VL 146,VL204	Sowing is almost complete across the state
	Paddy	10943	Pant Dhan 23, Pant Dhan 24, Pant Dhan 26, Pant Majhera Dhan 7, VL Dhan 68, VL Dhan 85, VL Dhan 158, VL Dhan 159. Hybrid Dhan (US 312 Gold, US 315, US 305)	Govind, VL Dhan-221, VL Dhan-156, VL Dhan-157, Vivek dhan-154	Nursery is complete and 20-30 % rice transplanting is already complete and remaining will be completed in 15-20 days as monsoon rains are received regularly. Black gram can be used as contingent crop in case there is any area left unsown due to delayed monsoon
	Pulses (Black gram)	2519	Pant Urd 19, Pant Urd 35, Pant Urd 40, Pant Urd 31,	Pant Urd 31 & Pant Urd 35	Sowing is started in hills and rest will be done during second fortnight of July and first fortnight of August
	Soybean	3193	PS-1225, PS-1347, PS 25,PS 26	PS 25 & PS 26	Sowing is almost complete across the state
	Fruit Crops				
	Peach	1900.23	Red June, Ashadi, Paradelux.	All these varieties can be planted in delayed conditions also with change in orchard management practices in case of delayed monsoon	In long term drought tolerant or less water requiring rootstock can be used and crop diversification with less water requiring or drought tolerant fruit crops such as pomegranate, ber etc. can be done especially in Sub tropical areas which are more susceptible for losses due to change in monsoon
	Plum	587.90	Santa Rosa, Red Beaut, Mariposa, Black Amber		
	Litchi	6.96	Rose Scented, Culcuttia		
	Vegetable Crops				
	Vegetable Pea	821.38	VL7, VL15, VL14, VL12	Arkel, Pant Sabji Matar-3, VL Sabji Matar-13, GS-10,	Garlic, Recent rains will provide conditions to grow early growing varieties and maintain optimum plant population.

				Matar Ageta-6 , Matar Ageta-7, PS1100, Pusa Prabhat	
	Tomato	733.65	Naveen 2000+, Manisha, Himsona, Him Pragati, Indum1313	Arka Vikas, K21, Pusa Gaurav, VL Tamatar4, VL Tomato Hybrid 1, Kashi Abhiman, Kashi Vishesh, Syngenta Sahoo, Pusa Rohini	Can be replaced with crops like cabbage, French bean, millets etc Mulching combined with life saving Irrigation if possible.
	Okra	108.12	Pusa Sawani, Parbhani Kranti, Pusa Bhindi-5,	Palam Komal, Arka Anamika, P-8, Kashi Pragati, Adventa Singham, Adventa Radhika	Can be replaced with crops like cabbage, French bean, millets etc Ensure Seed treatment and sowing immediately after effective rainfall.
	Cauliflower	281.21	Early Kunwari Pant Shubhra, Madhuri Girijaand Pusa Deepali	Pusa Him jyoti, Pusa Early Synthetic, Pant Gobhi-2 and Pant Gobhi-3, Safed Jawwan	Garlic, Cabbage, Raise seedlings in protected nursery and transplant immediately after effective rainfall.