

Drought Mitigation Through Knowledge Advisory

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ABSTRACT

Erratic and deficient behaviour of Monsoon 2009, seriously affecting 299 districts of 12 states, posed a genuine threat to food security. Krishi Vigyan Kendras located in drought stricken districts took up the challenge of mitigating drought. Quick assessment, technology dissemination, adoption and productivity stability measures were made using various methods of data collection like field observations, formal & informal group interaction and case study. The study indicated specific technical interventions by KVKs viz. introducing drought tolerant crops and varieties of oilseeds, pulses, cereals, vegetables, fruit crops, fodder crops, etc. Livestock related activities included animal health camps, demonstrations on fodder crops, trainings, etc. Major thrust was reflected on resource conservation technologies viz. direct seeded rice, system of rice intensification, drum seeding, ridge & furrow method, etc. Diagnostic visits, large scale adoption of short duration varieties particularly of paddy NDR-97, PRH-10 resulted in sustaining yield levels even in drought conditions. For creating mass awareness, print and electronic media, campaign, organization of technology weeks, farmer's goshties, exhibitions, etc. were extensively used.

Key words: Drought mitigating strategy; Role of KVKs;

With cumulative seasonal rainfall of the country as a whole during June 1 to August 2009 being 28% below the long period average, monsoon 2009 was erratic and deficient. Out of 36 meteorological subdivisions, the rainfall was excess/normal in 9 cases only, deficient in 24 and scanty in 3. The deficiency of 50% was noticed in western Uttar Pradesh and Rayalseema (Drought-Draft 2009). 299 districts of 12 states were declared drought. The sowing of rice was severely hit and reduction in annual coverage by 60 lakh ha was estimated. At the same time, there was indication of increase in acreage under bajra, jowar, cotton and pulses. To combat intensity of drought problem, knowledge advisory services were initiated at different levels by KVKs at district level with specific objective of minimizing drought risk in drought affected districts of the country.

The drought mitigation strategies included organization of awareness camps; diagnostic and advisory services, field visits and interactions with the farmers; organization of farmers' goshties; preparing contingent plan; providing technological backstopping and inputs mainly seeds and planting materials;

identification of relevant crops and varieties; organization of animal camps, conduct of technology week at KVK for showing the performance of technologies under drought conditions, etc. (Kokate, et al 2009).

The efforts showed good results with the adoption of relevant technologies- resource conservation, sowing of maize, bajra, oilseed & pulses; short duration rice; etc.

METHODOLOGY

The data from drought affected districts of Assam (14), Himachal Pradesh (12), Jharkhand (24), Manipur (9), Nagaland (11), Uttar Pradesh (58); Bihar (26), Karnataka (20), Maharashtra (28), Madhya Pradesh (37), Rajasthan (26) and Andhra Pradesh (21) were collected and analyzed. Quick assessment in terms of technology dissemination, technology adoption, productivity of crops, etc. was done. Various methods of data collection like field observations, formal & informal group interaction, feedback during field diagnostic services, etc. were used. The information and data were recorded at district level for two months. Case study method was also used for analyzing successful drought mitigation options.

RESULTS AND DISCUSSION

This section is divided in to five heads for presenting initiatives of advisory services.

Technology Advisory Services to the Farmers: Technology advisory services were performed through different activities organized by KVKs in drought hit districts of the country.

i) *Alternate crops/varieties for mitigating drought:* Introduction of alternate crops/varieties was one the major interventions taken up by KVKs. The focus was mainly on laying out demonstrations on oilseeds, pulses, millets, cotton, vegetables and short duration paddy.

Under oilseed, the major crops covered under demonstrations were sesame (423 ha), soybean (58 ha) and groundnut (54 ha). Arhar (501.5 ha), urdbean (146.5 ha), mungbean (31.5 ha), cowpea (7.0 ha) and rajmash (35.0 ha) were also included for demonstrations. In case of cereals, short duration paddy (605.7 ha), maize (101.4 ha), jowar (36.2 ha) and bajra (218.0 ha) were major interventions. Cotton (725.0 ha), French bean (3.2 ha), Niger (42.0 ha), sweet orange (30.0 ha), cashew (40.0 ha) and tapioca (4.0 ha) related technological demonstrations were also carried out. Thus, an area of 4302.50 ha was brought under alternate crops/varieties benefiting 17310 farmers (Table-1).

Table 1. Introduction of alternate crops/varieties for mitigating drought

State	Crops/Cultivars	Area (ha)	Number of beneficiaries
1. Uttar Pradesh	Sesame : G-2, Shekhar-1, RT-46, TKG-306	169.0	438
	Jowar: SPV-1616, CSV-13, CSV-5	28.0	108
	Bajra: BGM-52, Samrat-133, RJBH-555	64.0	196
	Paddy : N-97, PRH-10, Sarju-52, NDR-359	293.0	577
	Urdu: PU-31, PU-35, Shekhar-1, Uttara	71.0	204
	Mungbean: PDM-54, PDM-154, Meha, Samrat, Vishal	22.0	85
	Arhar: NA-1, Chamatkar, UPAS-120	180.0	315
2. Himachal Pradesh	Mash : UG-218, Palampur-93, HIM-1 < KU-59	33.5	249
	<i>Frenchbean:</i> Alka Kamal, Falguni, Contender	1.2	16
	Soybean : Harit Soya, Palam Soya, Shivalik	8.0	43
	Rajmash: Jwala, Kanchan, Kailash	3.5	72
	Cowpea: Himachal Lobia-1	4.0	28
	Arhar: Sarita	4.0	33
	Mungbean: SML-668	2.0	12
	Maize: Saphriya, KH-9452, Mitra, Pro agro-4642	58.2	87
3. Rajasthan	Bt cotton : (Bio-6488, MRC-6825, MRC-7017)	335.0	361
	Guar : RGC-1066, RGC-1002, RGC-1017, RGC-1055	131.5	2812
	Sesame : RT-127		
	Bajra: Raj-171, ICMH-356, HHB-67	139.0	2382
	Urdbean: RBU-38, PU-35	12.5	45
	Mungbean: RMG-268, RMG-492, G-8	78.0	209
	Groundnut : TG-37 A, TBG-39, HNG-10	40.0	48
4. Manipur	Urdbean: T-9, Maize : HQPM-1, Soybean : JS-335,	27.5	28
	Groundnut : ICGS-76, TAG-24		
5. Assam	Sesame (ST-1683, AST-1)	210.0	45
	Jowar (Swarna), Urdbean (Pant U-19, T-9), Mungbean (K-857)	3.2	24
	Paddy (JR-2, Aghani, Panjit, Ketekijaha	8.5	12
6. Karnataka	Horse gram (GPM-7, PHG-9)	25.0	62
	Redgram (BSMR-736, MRG-2, Maruti, Asha, ICPL-87119)	56.0	107
	Cotton (DHB-105, MRC-7918, DDHC-11)	66.0	158

	Maize (Nitya Sri, NAC-6004)	35.0	85
	Bajra (MH-946, ICTP-8203)	15.0	22
	Jowar (CSH-14)	5.0	9
	Frenchbean AH-4)	2.0	5
	Cowpea (IT-38956-1)	3.0	10
	Groundnut (GPBD-4)	4.0	78
7. Bihar	Paddy (Pusa-837, Rajendra mansuri-1, PRH-10, Gautam, Prabhakar, Prabhat, Richhana)	304.2	877
	Redgram (NA-1, Malviya-13, Pusa-9, Bahar, Malviya-6)	186.5	530
	Niger (JML-6, BNS-12, Birsa Niger)	42.0	121
	Sesame (Pragati, Gujrat til-1, Krishna)	40.0	99
	Groundnut (TG-22, BR-12)	10.0	30
	Soybean (JS-93-05)	5.0	20
	Blackgram (PU-19)	2.0	8
	Maize (QPM Shaktiman)	8.2	24
8. Jharkhand	Paddy, maize, arhar, sesame, urd, moong	1020.0	5300
9. Maharashtra	Cotton (Mallika Bt, AKA-8, NCS-145)	404.0	1200
	Soybean (MAUS-71, JS-9305, DS-228)		
	Redgram (BDN-708, Vipula, BSMR-853)		
	Kulthi (Dapali-1) Maize (Karveer), Cowpea (Kankan Sada Bahar), Ragi (Ragi Deepali-1)		
10. Andhra Pradesh	Redgram (PRG-158, LRG-41, MRG-1004)	35.0	66
	Soybean (PS-1029)	5.0	13
	Greengram (WCG-37, LGG 460)	15.0	24
	Bt Cotton (Mallika)	10.0	14
	Sweet organge (Batavion)	30.0	4
	Cashew (Cashew local)	40.0	4
	Tapioca (H-165)	4.0	3
	Sesame (Chandan)	4.0	8
	Total	4302.5	17310

Table 2. Farmers-Scientists interaction on livestock management

State	Livestock components	Number of interactions	Number of participants
1. Himachal Pradesh	Animal husbandry related problems and fodder management	10	293
2. Bihar	Feed & fodder management, animal health related issues	29	2589
3. Jharkhand	Livestock and alternate fish management	21	1198
4. Assam	Animal husbandry, fish farming, poultry farming in drought situation	12	286
5. Manipur	Awareness campaign on livestock problems in all the districts	9	300
6. Uttar Pradesh	Goat rearing, cow and buffalo husbandry, fish farming, poultry farming, fodder production	222	7610
7. Andhra Pradesh	Animal husbandry, fishery and fishery related issues	8	107
8. Maharashtra	Animal husbandry, fishery	9	289
9. Rajasthan	Improved technologies of goat, pig, sheep, buffalo and care of milch animals during drought and fodder production	45	1297
10. Madhya Pradesh	Feed & fodder technology, poultry management, dairy management	15	368
11. Chhattisgarh	Livestock management	10	250
12. Karnataka	Livestock related technology	9	289
	Total	399	14876

ii) *Farmers-Scientists interaction on livestock management*: Livestock were adversely affected due to drought and the problems like shortage of fodder and incidence of different diseases and pests and deficiencies were observed. KVKs conducted farmers-scientists interaction on rearing practices, fodder production, sensitization about health related problems, etc. 399 interactions were held with the participation of 14876 stakeholders. Animal health camps (298) were organized in which 49731 animals were attended (Table-2 & 3).

Table 3. Animal health camps organized by KVKs

State	Number camps	Number of animals	Number of families
Himachal Pradesh	6	316	46
Bihar	57	15379	2662
Jharkhand	26	5705	938
Assam	93	967	197
Manipur	3	102	88
Uttar Pradesh	56	14734	2709
Maharashtra	17	1676	630
Rajasthan	15	5094	936
Madhya Pradesh	13	3646	932
Chhattisgarh	2	50	50
Karnataka	10	2062	386
Total	298	49731	9574

iii) *Addressing drought through short duration paddy-Case of KVK Jaunpur*: Krishi Vigyan Kendra, Jaunpur intervened with short duration paddy variety NDR-97 under drought condition. NDR-97 is a crop of 90 days and has been accepted by local farmers due to its attributes like short duration, high yielding, quality rice and suitable for rainfed as well as upland and irrigated conditions. In kharif 2009, this variety was transplanted on 1375 ha area on the fields of 4860 farmers of the district. Considering quality traits of this variety, seed distribution programme was chalked out with the purpose that vegetable growers of the district may incorporate this variety in their vegetable based cropping systems so as to enhance the cropping intensity, profitability and food security.

Initially, the KVK started the seed production programme through participation of 100 farmers belonging to 100 Nyay Panchayats covering 10 vegetable growing blocks of the district with an understanding that such produce will be used only as

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seed and not as rice to be supplied to the consumer market. As a result of this strategy, the farmers could harvest a production of 1350 q. of paddy seed during 2008-09. Out of 1350 q of seed produced, 550 q has been distributed among 4860 farmers on exchange and sell basis in kharif 2009.

The crop of NDR-97 was harvested during last week of September to Ist week of October, 2009. The farmers got a good harvest of this variety under rainfall/water stress condition. A harvest of 40 q/ha was obtained at farmers' fields with cost of cultivation of Rs 18250, gross income of Rs 37600, net income of Rs 19350 and B: C ratio of 2.1:1.

iv) *Direct Seeded Rice- A case Study of KVK, Kushinagar* : Total reported area of district Kushinagar is 291573 ha, out of which net sown area is 220838 ha and irrigated area is 160898 ha. Soils are sandy loam to loam and clay loam. The cropping intensity is 151.36%. The major crop grown in Kharif is rice (119909 ha) with the productivity of 20.09 q/ha. Fertilizer consumption is 160.98 kg/ha with an application of NPK @ 117.27, 33.55 and 10.17 kg/ha, respectively. Rice-Wheat is the major cropping system that occupied approximately 237897 ha area in district.

Direct Seeded Rice through Zero tillage Machine along with improved production technologies in paddy were demonstrated under Rice-wheat cropping system at the farmers' fields. Under rice-wheat cropping system, farmers annually grew long duration traditional paddy varieties which gave low yield and also required more number of irrigations and agronomic practices. During Kharif 2009, frontline demonstrations on improved paddy varieties through conventional method and direct seeded rice (DSR) were given to 116 farmers on an area of 39.22 hectare. Rice sowing was done by Zero-till Seed cum ferti drill at a seed rate of 40 kg/ha in case of improved varieties and 12.5 kg/ha for hybrid. Weeds are the major threat in direct seeded rice therefore, pendimethaline @ 1 kg a.i./ha was applied next day after sowing, it was followed by application of 2,4-D @ 0.5 kg a.i./ha in 500 liter of water to control broad leaf weeds and sedges at 25 DAS. One manual weeding was also done at 35 DAS to eliminate some of the escaped weeds. Other cultural operations were similar to transplanted rice except application of butachlore @ 1.25 kg a.i./ha at 2 days after transplanting (DAT).

Table 4. Results of demonstrations on DSR

Variety	Area (ha.)	Number of Farmers	Number of Villages	Date of DSR	Av. plants height (cm)	Av. No. of tillers/sq.m
Rajshree	22.76	77	11	27-05-2009 to 16-06-2009	145.66	614.35
Rajendra mahsoori	12.22	36	7	27-05-2009 to 16-06-2009	135.45	584.25
Pusa-44	4.22	14	4	703-06-2009 to 31-06-2009	166.6	476.12
PB-1	8.56	16	8	03-06-2009 to 31-06-2009	126.40	422.80

Table 5. Results of front line demonstrations on DSR (Hybrid PRH-10)

Hybrid	Area (ha.)	Number of Farmers	Number of Villages	Date of DSR	Date of harvesting	Av. plants height (cm)	Av. No. of tillers/sq.m
1	2	3	4	5	6	7	8
PRH-10	9.4	7	2	15-06-2009 to 16-06-2009	6-10-09 to 10-10-09	117.38	435.43

Highest grain yield (q/ha)	Average grain yield (ha)	Lowest grain yield (q/ha)	Average cost of cultivation in ha	Gross Return	Net Profit	B.C. Ratio
9	10	11	12	13	14	15
78.52	62.35	53.87	16950.00	59232.00	44282.00	3.49:1

Major emphasis was given to include short duration, high yielding paddy varieties along with Direct Seeded Rice (DSR) with imposition of IPM and IPNM technologies mainly aimed at to save irrigation water, optimization of input cost and resource conservation. The performance is presented in Table 4-5.

v) *Large scale adoption of resource conservation technologies*: Different types of resource conservation technologies were introduced in different states. An area of 36675.50 ha with the participation of 56719 farmers was brought under demonstrations on resource conservation technologies in 11 states facing drought. Direct seeded rice, system of rice intensification, mulching, integrated farming system, short duration pulses, rainwater harvesting, etc. were major technological options adopted for resource conservation. In case of Himachal Pradesh, mulching in fruit crops, protective cultivation of vegetables, LDPE tank, roof top rain water harvesting were important measures initiated by KVKs. In Rajasthan, drip and sprinkler irrigation, insitu moisture conservation, sowing of low water requiring crops, were major observations. In Manipur and As-

sam, emphasis was laid on integrated watershed development and soil and water conservation technologies. In Bihar, mulching, crop residue management, inter cropping in groundnut, sunflower and red gram were emphasized along with insitu-moisture conservation. The technologies like DSR, stake bed rice, mulching, summer ploughing and zero tillage technologies were practiced. Jharkhand adopted technologies like paddy drum seeder, SRI and rain water harvesting. In states like Maharashtra and Andhra Pradesh, the emphasis was given on mulching, insitu moisture conservation, SRI, DSR, inter cropping, moisture conservation technologies, etc. (Table-6).

vi) *Awareness Campaign*: Krishi Vigyan Kendras organized number of meetings, gosthies, field days, technology weeks, farmers fairs, exhibitions in order to make farmers aware about various aspects of drought management. Newspapers, radio and television were extensively used for spreading the message on mitigating drought through adoption of suitable technological options. Websites and help line numbers were also utilized for spreading the message.

Table 6. Large-scale adoption of resource conservation technologies

State	Crops/Cultivars	Area (ha)	Number of beneficiaries
Himachal Pradesh	Mulching in fruit crops, protective cultivation of vegetables, LDPE tank construction, root top rain water harvesting,	599.0	203
Bihar	Direct seeded rice, stake bed rice, mulching, summer ploughing, zero tillage technology	2049.0	4501
Jharkhand	Paddy drum seeder, SRI, rainwater harvesting	732.5	1410
Assam	Soil & moisture conservation technologies	-	-
Manipur	Integrated watershed development	-	-
Uttar Pradesh	Direct seeded rice, System of rice intensification, mulching, integrated farming system, short duration pulses introduction, rain water harvesting, etc.	1000.0	7677
Andhra Pradesh	Paddy drum seeder, Direct seeded rice, inter cropping system, soil & moisture conservation technologies	370.0	492
Maharashtra	Mulching, insitu moisture conservation, ridge & furrow method, construction of checkdams, SRI, etc.	16763.0	23070
Rajasthan	Drip and sprinkler irrigation insitu moisture conservation, sowing of low water crops	14.0	61
Chhattisgarh	Direct seeded rice		
Karnataka	Mulching, crop residue management, intercropping in groundnut, sunflower, onion, redgram, insitu moisture conservation, etc.	15148.0	19305
	Total	36675.5	56719

Table 7. Diagnosis of problems

S. No.	Diagnosed problems	No. of visits	No. of villages covered	No. of beneficiaries
1	Insect and pest infestation in crops, vegetable and fruit	300	274	10980
2.	Physiological disorder in fruit crops	8	16	163
3.	White grub, stem borer and leaf roller in paddy	71	37	1207
4.	Insect-pest infestation in cereals	259	330	2946
5.	Insect-pest infestation in oilseed & pulses	401	160	1442
6.	Animal/fish disease identification	79	62	583
7.	INM/Soil management	19	27	107
8.	Women empowerment	9	7	45

vii) Activities Organized during Technology Week:

Organization of technology week for 5 days was initiated by KVKs and different activities related to drought mitigation were conducted. The major activities undertaken during technology week were training for farmers, farm-women, rural youth; exhibition; scientist-farmers interaction; farmers' goshies; exposure visit, visits to crop cafeteria and demonstration unit; diagnostic services; distribution of seed and planting material and drought relevant literature, etc. 18 KVKs organized technology week with the organization of 76 farmers goshies, visit to 152 demonstration units, 2239 farmers' visits, 27 exhibitions and distribution of literature among 11258 farmers.

viii) Diagnosis of Problems: KVKs made extensive visits to the villages for identification of problems and on the spot advice. The visits helped in identification of insect pest and diseases of crops, vegetables, fruits and also the animals. 56 animal camps were organized for treatment of animals (Table 7).

CONCLUSION

KVKs established in drought hit districts took up the challenge of mitigating drought by undertaking various activities and providing technological inputs like seeds, planting materials, bio-fertilizers, bio-agents and byproducts and through awareness and skill development programmes. Specific technical interventions were made by KVKs by introducing drought tolerant crops and varieties of oilseeds (soybean, groundnut, toria, etc.), pulses (pigeonpea, urdbean and mungbean, etc.) and cereals, vegetables, fruit crops, fodder crops, etc. Livestock related activities (animal health camp, fodder crops, trainings, etc.) were also

taken up on large scale. Major emphasis was given on resource conservation technologies like direct seeded rice, system of rice intensification, drum seeder, ridge & furrow method, etc. Diagnostic visits to farmer's fields were made for solving the agriculture & livestock related problems on the spot. Thrust was given on large scale adoption of short duration varieties particularly of paddy (NDR-97, PRH-10, etc.). For creating mass awareness, print and electronic media, campaign, organization of technology weeks, farmer's goshties, exhibitions, etc. were extensively used. The network of KVKs acted as main actor for minimizing risk of drought by technology advisory services to the farmers.

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