Journal of Agrometeorology 9(2) : 259 - 264 (Dec. 2007)

Application of weather based agroadvisories in eastern dry zone of Karnataka

B.T. RAVINDRABABU, N.A.JANARDHANA GOWDA, N.JAGADEESHA, K.R.RAJASHEKHAR and M.B.RAJEGOWDA

University of Agricultural Sciences, GKVK, Bangalore, Karnataka, INDIA

ABSTRACT

The weather parameter values viz., rainfall, temperature and cloud cover forecasted at medium range level (3-5 days) and observed from 1996 to 2005 were compared. During southwest monsoon period, the forecast of rainfall was realized to an extent of 40 per cent as compared to 62 per cent and above for other seasons. The mean seasonal Ratio Score (RS) ranged between 54.0 and 93.6 per cent and Hanssen and Kuipers' (HK) scores ranged from 0.11 to 0.27. The mean annual usability of rainfall, maximum and minimum temperature and cloud amount are 61.7, 79.6, 77.6 and 72.9 per cent respectively. The forecasts were found to be encouraging and of economic benefit to the AAS farmers compared to Non AAS farmers sampled.

Key words: Weather forecast, agriculture, reliability, rainfall, temperature

Weather condition during cropping period plays a major role in success or failure of agricultural crop production. Agricultural operations can be advanced or delayed with the help of advance weather forecasts from three to ten days. An estimate made by agribusiness community in western countries indicated that the forecast can be put to an economic use if it is 50-60 per cent realized (Seeley 1994). An agriculturally relevant forecast is not only useful for efficient management of farm inputs but also leads to precise impact assessment (Gadgil 1989). The National report of NCMRWF (Anon, 2002) and Ranbir Singh *et al* (2005) also indicated the economic benefit of the advisories for different agromet field units that ranged between Rs. 330/ and 3750/- and 1410 to 1885/- per hectare for maize, wheat and rice crop, respectively. This paper attempts to verify the suitability of the medium range weather forecast and its impact on economic returns for a few crops in Eastern dry zone of Karnataka state.

MATERIALS AND METHODS

The Karnataka state is located between 11.5° N and 18.5° N latitudes and between 74° E and 78.5° E longitude. The elevation varies between 600 m to 900 m above mean sea level (Rajegowda 1990). The state comprises of ten agro climatic zones. The geographical location of the study area lies in the Eastern Dry zone has an altitude ranging from 800 to 900 m above

mean sea level and annual rainfall ranging from 679 mm to 889 mm. It comprises of four districts viz., Bangalore urban, Bangalore rural, Kolar and parts of Tumkur district representing 9.1 per cent of the total cropped area of the State (Karnataka at glance 2002-03). The main crops are Finger millet, rice, red gram, groundnut, short duration pulses, and horticultural fruit crops and off- season vegetables with protective irrigation. In addition, poultry, dairy and mulberry cultivations and sericulture are important agricultural activities in the region. The southwest (SW) monsoon season is more important for crop production in this region and it was highly helpful to the small and marginal farmers.

Medium range forecast on rainfall amount, cloud amount, maximum and minimum temperature issued for the period from 1996 to 2005 for the Bangalore was compared with the observed values of weather station located at the University of Agricultural Sciences campus, Bangalore. To asses the reliability of weather parameters, different verification methods were used. The forecasts of rainfall, temperature and cloud covers have been verified by calculating the error structure. The correct and usable cases summed up and the combined values indicate the per cent usability of the forecasts. Ratio score (R.score) describes the success rate of correct forecasts of occurrence of rainfall to the total events. It varies from 0 and 1 as 1 indicating perfect forecast and Hanssen and Kuipers' score (H.K. score) indicates the ability to discriminate between rainy and non rainy days. It ranges between -1 and +1 through the 0, the zero indicating no skill. The verification of weather forecasts was done for four seasons viz., Pre-monsoon (March-May), Southwest monsoon (June-September), Northeast monsoon (October--December) and Winter Season (January--February) as defined by India Meteorological Department. methods prescribed by NCMRWF (Singh *et al.* 1999) were used for verification of forecasts.

i) Error Structure

Rainfall	Correct	$\pm$ 10%
	Usable	$\pm$ 20%
Temperature	Correct	$\pm$ 1.0^{o}C
	Usable	$\pm$ 1.0 to $\pm$2.0^{o}C
Cloud cover	Correct	$\pm$ 1 Okta
	Usable	$\pm$ 1 to $\pm$2.Okta

ii) Ratio Score and Hanssen and Kuipers' score .

Forecast	**Observed**		
		Rain (Y)	No rain (N)
	Rain (Y)	YY	NY
	No rain (N)	YN	NN

Ratio score = (YY+NN)/ N *100

where, N = YY+NN+YN+NY is the total number of days

Hanssen and Kuipers score = (YY x NN) – (YN x NY)/(YY+NN) – (NY+YN)

Table 1: Qualitative analysis of rainfall forecast and realization

Season	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Mean (1996-2005)
Ratio Score (%)											
Winter season	100.0	95.0	100.0	95.1	80.4	97.8	95.0	98.0	93.0	81.8	93.6
Pre monsoon	80.9	67.3	68.0	78.7	73.9	86.3	83.3	81.3	70.8	65.5	75.6
South west monsoon	50.0	50.0	56.7	48.5	54.6	54.6	59.0	61.0	56.6	49.1	54.0
North east monsoon	86.4	73.0	74.0	76.7	93.2	66.7	80.0	87.0	88.8	63.5	78.9
Whole year	68.7	62.7	67.6	68.1	69.6	70.4	74.6	75.5	71.5	62.3	61.7
Hanssen and Kuipers Score (H.K.score)											
Winter season	0	0	0.35	0	0.57	0	0	0	0.04	0.15	0.07
Pre monsoon	0.36	0.21	0.25	0.13	0.40	0.48	0.32	0.35	0.32	0.17	0.30
South west monsoon	0.16	0.16	0.24	0.26	0.17	0.14	0.26	0.17	0.19	0.08	0.18
North east monsoon	0.14	0.35	0.29	0.13	0.63	0.19	0.14	0.11	0.34	0.36	0.27
Whole year	0.36	0.38	0.35	0.15	0.26	0.42	0.35	0.32	0.34	0.31	0.32

Table 2: Overall usability (%) analysis of the forecasted rainfall for all years/ seasons

Season	Rainfall										
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**Mean (1996-2005)**
Winter season	100	95	100	95	81	98	95	98	96	100	95.8
Pre monsoon	67	62	60	74	69	80	84	87	57	86	72.6
South west monsoon	28	45	30	45	26	25	42	69	33	50	39.3
North east monsoon	95	81	65	74	85	62	80	98	85	56	78.1
Annual	54	58	48	64	55	57	68	83	58	72	61.7

Evaluation on implementation of Agromet Advisories by the farmers, regular estimation of benefit/loss on each item of the advisory realized at the farmers level, economic benefit/loss on adoption of the agroadvisory issued by the agromet division compared with the non-AAS farmers. For this purpose, about 80 farmers from four villages near the nodal centre have been identified to know the economic benefit obtained by the farmers adopting the Agromet advisories. A field survey of the study area was conducted and feedback from twenty farmers from each village were collected and summarized by recording the yield of the crops from two

Table 3: Range and mean usability (%) for temperatures and cloudiness for the period

Season	Maximum temperature		Minimum temperature		Cloud amount	
	Range	Mean	Range	Mean	Range	Mean
Winter season	100-74	87.7	92-55	72.1	98-66	87.6
Pre monsoon	88-70	80	93-58	74.5	99-50	75
Southwest monsoon	91-71	79.1	96-72	85.5	95-40	66.1
North east monsoon	95-71	83.9	84-62	72.1	95-48	75
Annual	89-67	79.6	88-58	77.6	76-62	69.2

situations viz., recommended practices with agro-advisory and recommended practices without agroadvisory.

RESULTS AND DISCUSSION

Rainfall

The ratio score and their respective HK scores were presented in table 1. The Southwest monsoon, which is the main rainfall-producing season recorded lowest percentage of usability and it varied from 25 to 69 per cent (Table 2). The forecast on rainfall during northeast monsoon, winter and pre monsoon period showed usability percentage between 56 and 98 per cent, 81 and 100 per cent and 57 to 87 per cent respectively. Similar observations have also been reported by Singh *et al* (1999) and Ranbir Singh *et al* (2005) for Delhi, Pantnagar, Ludhiana and Palampur agro-climatic regions. The mean H.K score was higher in Premonsoon and North east monsoon seasons compared to other seasons. Considering the quantitative data, the overall usability of rainfall, temperature (Maximum & Minimum) and Cloud amount parameters have been worked out and presented in Table 3.

Benefit of forecast

The Village survey conducted to assess the overall utility of forecast revealed that the medium range weather forecast for undertaking all farm activities is excellent in 35 per cent cases; very good in 12 per cent, good in 26 per cent and 28 per cent as satisfactory. In this region, 76 per cent farmers sampled rated the usefulness of forecast between good to excellent. More than 75 per cent of the farmers sampled believed that the MRWF was beneficial for Land preparation /sowing, pest and disease control/sprays, fertilizer and manure application, weed control, protective irrigation and harvesting. Such findings were also reported by Patel *et. al.* (1998) and Ranbir singh *et al.* (2005).

Table 4: Economic impacts of agroadvisory

Crops	AAS Farmers (acre)				Non-AAS Farmers (acre)				Additional Income to AAS farmers (Rs.)	(%) of gain over Non AAS Farmers
	Yield (kg)	Total cost (Rs)	Net return (Rs)	Benefit: Cost	Yield (kg)	Total cost (Rs)	Net return (Rs)	Benefit :Cost		
Finger millet(K)	850	4550	3500	1.78	750	4956	1869	1.53	1631	16.0
Red gram(K)	490	4258	11027	3.59	370	4974	7641	2.17	3386	65.0
Tomato (R)*	330	9848	6652	1.67	280	10675	3325	1.31	3327	27.5
French bean(R)	898	8143	27777	4.41	757	9015	21270	3.35	6507	31.6
(K) Kharif (R) -Rabi * - Hybrid										

The crop yield, total cost of cultivation, net returns and the Benefit: Cost for a few crops grown by the AAS and Non-AAS farmers during *Kharif* and Rabi seasons of 2004 are presented in Table 4. The cost of cultivation was found to be lower in the case of AAS farmers who have been effectively adopted the advisory time to time as compared to the Non-AAS farmers. Further, the crop yield is also higher with low investment with the AAS farmers which resulting in higher Benefit: Cost ratio. The per cent gain of AAS farmers over Non AAS farmers worked out by the difference in Benefit: Cost ratio values of AAS farmers and Non AAS farmers dividing by the Benefit: Cost ratio of Non AAS farmers and multiplied by hundred. There is a considerable benefit ranging from 16 to 65 per cent to the AAS farmers over the non AAS farmers when followed the agro advisory bulletins prepared based on the Medium Range Weather Forecast issued by NCMRWF. Hence, the MRWF is found benefited to the farming community.

REFERENCES

Anonymous, 2002. Background paper for11th Annual Review Meeting of National Centre for Medium Range Weather Forecasting (NCMRWF) New Delhi. *In:* Status of economic impact. pp 1-3.

Gadgil, S. 1989. Monsoon variability and its relationship with agricultural strategies. *Paper* presented at International symposium on climate variability and food security in developing countries. Feb 5-7,1987, New Delhi, India pp 249-267.

Karnataka at a glance 2002-03 , Directorate of Economics and Statistics, Banglore

Patel , H.R., Shekh, A.M. and Venkatesh,H. 1998. Status of present day weather forecasting to farmers: A case study

of middle Gujarat region. *Annals Agric. Res.,* 19(3): 285-289.

Rajegowda, M.B., 1999. Climatic conditions in different Agroclimatic zones of Karnataka, Published by UAS, Bangalore pp -1.

Ranbir Singh Rana , Rajendra Prasad and Suresh Kumar 2005 Reliability of Medium range weather forecast in mid hill region of Himachal Pradesh. *J. Agrometeorol.,* 7(2): 297-303

Seeley, M. W. 1994. The fhture of serving agriculture with weather/climate information and forecasting: some indications and observations. *Agric. Forest Meteorol., 69:47-59.*

Singh, S, V, Rathore, L. S. and Trivedi, H. K. N. 1999. Verification of medium range weather forecasts, (in) *Guide for Agrometeorological advisory services* pp 73-81. (Eds) National Centre for Medium Range. Weather Forecastmg, Department of. Science and Technology, -Government of India.