Open Access

© 2023, Centre for Advanced Research in Agricultural Sciences
Research Journal of Agricultural Sciences
Volume 14; Issue 01; pp 143–149

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

Full Length Research Article

Risk Assessment of Crop Failure: Need for Crop Insurance in Districts of Rajasthan, India

Neha Arora*[1], Swati Rajput[2] and Sanjeev[3]

[1-2] Shaheed Bhagat Singh College, University of Delhi, New Delhi - 110 017
[3] University of Delhi, New Delhi, Delhi - 110 021

Abstract

Crop failure due to natural hazard and other human interventions can cause a serious matter of concern to a rural population dominated agricultural country like India. The issue of food security and nourishment pose a major stress to the economy and sustainability of agriculture in the near future. Agricultural risk can be categorized as production risk, price or market, financial or credit, and institutional risks etc. The farmers are not assured of good quality and disease-free crop which is essential for obtaining reasonable yield sufficient to recover expenses. Crop insurance is one of the major management strategies to overcome risk to greater extent. The present study is focused on assessing the parameters of risk and identifying the risk prone zones and stressing the need for crop insurance as a measure of mitigation in districts of Rajasthan.

***Key words*:** Crop failure, Risk assessment, Crop insurance, Mitigation

The enterprise of agriculture is subject to lot many uncertainties. Still, more people in India earn their livelihood from this sector, than from all other economic sectors put together. Agricultural associated with several risks which include adverse changes in both input and output prices. It is necessary to define term risk, vulnerability, exposure and resilience in order to understand risk in agriculture. The term risk is defined as uncertain events that lead to losses. The uncertainty can arise from when the events will occur and/or the impact they may have. Hazards that affect agriculture: Some of the common hazards that produce such risks include weather phenomena (drought, excess rainfall, high temperatures, frosts, hail, high winds, etc.), animal and/or plant pests and/or disease outbreaks, as well as international commodity price variations (for countries that are price takers). Exposure is the likelihood of a risk occurring in the context in which an actor (i.e., a farmer or agribusiness) is operating in. So, if a farmer is using a regular seed or a drought resistant seed, the likelihood of drought risk would be different (although the hazard is the same). Vulnerability is an actor's ability to manage a risk, given its exposure to that risk. Some farmers may be more vulnerable than others if they lack access to financial services, such as savings, credit or insurance. Linked to the concept of vulnerability, is the concept of resilience described below. Resilience is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner.

Agricultural risk can be categorized as production risk, price or market, financial or credit, and institutional risks etc. The farmers are not assured of good quality and disease-free crop which is essential for obtaining reasonable yield sufficient to recover expenses. Crop insurance is one of the major management strategies to overcome risk to greater extent. It is regarded as an essential part of well-rounded agricultural program designed to provide protection to farmers against physical failure of crops due to weather and other unavoidable natural hazards. Compared to other traditional risk reducing strategies, such as crop diversification, inter-cropping, mixed farming, integration of farm etc., available to farmers crop insurance is more efficient. If a farmer is assured of financial compensation when his income is considerably low for reasons beyond his control, he would more likely allocate his resources in a manner that would maximize his return. Crop insurance not only helps the farmers to withstand the shock from uncertain situation but also acts as incentive to use the resources efficiently and achieve higher level of productivity. Hazell and Valdes [1] indicated that risk and uncertainty pose a serious impediment to agriculture development. One method of setting risk to farmers is through crop insurance. He also suggested that if the crop insurance program is to be useful in agricultural development, it must be carefully reworked to maximize their

Received: 14 Nov 2022; Revised accepted: 02 Jan 2023; Published online: 18 Jan 2023

Correspondence to: Neha Arora, Shaheed Bhagat Singh College, University of Delhi, New Delhi - 110017, Tel: +91 9599618394; E-mail: nehaarora.geo@gmail.com

Citation: Arora N, Rajput S, Sanjeev. 2023. Risk assessment of crop failure: Need for crop insurance in districts of Rajasthan, India. *Res. Jr. Agril Sci*. 14(1): 143-149.

efficiency for both farmers and governments. Agricultural crop insurance is one of the major management strategies to overcome risk to greater extent. Insurance of crops is regarded as an essential part of well-rounded agricultural programme designed to provide protection to farmers against physical failure of crops due to weather and other unavoidable natural hazards. Crop insurance advances the process of stabilizing the agricultural industry to a stage of production, making such a process more comprehensive, effective and useful [2]. The agricultural production in India is highly dependent upon the vagaries of monsoon. There is a considerable variation in the occurrence of rainfall with wide diversity in the seasonal and annual distribution pattern. It culminates into a great amount of losses due either to the floods or droughts. Under the situation of risks and uncertainties in agriculture; a farmer hesitates to take decisions related to adoption of new technologies, cultural practices and use of adequate quantities of various costly inputs. This in turn affects farm production and farm economy [3]. Hence, there is a need to stabilize and protect farm economy through adoption of appropriate measures. The most rational method of protecting farmer's economy from different types of risk is to provide some kind of shield against the possible adverse effect of different risks. The 'crop insurance program' could, therefore, be considered not only as a hedge to protect farm economy from the adverse effect of crop failure but also as an incentive to the farmer to shoulder risk of using new technology and affecting improvement in farming [4]. The process of modernization of agriculture could be accelerated with the introduction and adoption of crop insurance program [5]. Insurance is a technique in which losses suffered by few are met from funds accumulated through small contributions made by many who are exposed to similar risks. Crop insurance is a means to protecting the cultivators against financial loss on account of anticipated crop- loss arising out of practically all natural calamities such as natural fire, drought, floods, pests, diseases, etc. [6]. The sum insured could be the total expenditure or a multiple of it or a proportion of expected income from crop(s) for which premium is paid. The indemnity (claims payable against the paid out of pocket expenses) is payable on the basis of shortfall in average yield from the guaranteed yield (threshold yield). The claims are paid after the loss in yield is ascertained.

Variations in the performance of agricultural growth across states and year to year fluctuations are major causes for concern for long term food security and also for welfare of farmers. Farmers primarily face two types of risks – yield risk and price risk. An unplanned and major variation in either the yield or price of a crop in a particular agricultural cycle can translate into significant losses to the farmer. Yield risk refers to uncertainty regarding the quantity and quality of agricultural product harvested at the end of an agricultural cycle. Erratic rainfall distribution has an adverse impact on agricultural production. On an average, crops on 12 million hectares of land are damaged annually by natural calamities and adverse seasonal conditions in the country (Planning Commission, Eleventh Five-year Plan, 2007- 2012). In the last fifteen years, there have been several years when deficiency in rainfall has adversely affected agricultural production. In 2002, rainfall deficit was 19 per cent due to which there was a loss of 38 million tonnes of food grains. The 2009 drought was the third worst since 1901, when a rainfall deficit of 18 per cent was recorded and there was a production loss of about 16 million tonnes of food grains. Price risk refers to the uncertainty about prices that farmers receive for their produce. During years of high production, prices of crops slide downwards, affecting the incomes of farmers. There have been times when higher production of crops has led to prices falling to very low levels, even below MSP levels as happened after the Kharif of 2016 and 2017 in case of several pulses and oilseeds. Furthermore, farmers have not been adequately protected by MSPs in all states. Although MSPs are announced by the government for 23 commodities, they are mainly implemented for rice and wheat and that too in a few states of the country. The price risk is becoming more pronounced as Indian agriculture opens to global trade. In 2017-18, prices of several agricultural commodities like tur, urad, soybean, groundnut etc remained much lower than MSP causing widespread distress to farmers in several states [7].

Weather variability and uncertainty of crop yields is a basic risk faced by agriculturalists worldwide. However, the magnitude and intensity of this is particularly high in India owing to extreme dependence of the farm sector on weather conditions and the poor economic condition of the overwhelming majority of farmers who have extremely limited means and resources to cope with the disastrous consequences of a crop failure. Given the importance of the agricultural sector to the growth trajectory of the economy and the inevitability of climatic aberrations playing havoc with crop production, the need for and benefits of crop insurance hardly need elaboration. The focused approach on crop insurance as a planned mechanism to mitigate the risks of natural perils in farm production has resulted in the evolution and improvement in the crop insurance programme over the years [8].

The first nation-wide crop insurance scheme was the Comprehensive Crop Insurance Scheme (CCIS) introduced in Kharif, 1985-. This scheme was based on an area approach and area units were identified for the purpose of assessing indemnity. This was replaced by National Agriculture Insurance Scheme (NAIS) in Rabi 1999-2000, which was further changed to the Modified National Agricultural Insurance Scheme (MNAIS) during Rabi 2010-11. Apart from these schemes, several other pilot projects such as Seed Crop Insurance (1999- 00), Farm Income Insurance Scheme (Rabi 2003-04) and Weather Based Crop Insurance Scheme (Kharif 2007) were implemented from time to time. In April 2016, Pradhan Mantri Fasal Bima Yojana (PMFBY) - an area-based scheme and Restructured Weather Based Crop Insurance Scheme (RWBCIS) was introduced. Pradhan Mantri Fasal Bima Yojana (PMFBY) - Kharif 2016 onwards realizing the limitations of existing system of crop insurance that was not able to meet the needs of farmers, the NDA government announced a new crop insurance program. PMFBY scheme became operational from Kharif, 2016 with an objective to provide adequate insurance coverage and financial support to the farmers in the event of crop failure. Features of the new scheme:

(i) *Sum Insured*: The sum insured is equal to the Scale of Finance (SoF) for that crop as fixed by District Level Technical Committee. Sum Insured for individual farmer is now equal to the Scale of Finance per hectare multiplied by area of the notified crop proposed by the farmer for insurance. The scale of finance takes into account the cost of cultivation on the basis of land quality, irrigation expenses and facility as well as cost of fertilizers, seeds and labour which varies from one district to another.

(ii) *Premium rates*: The premium rates payable by farmers for Food Crops and Oilseeds (FCOS) is fixed at 2 percent of the Sum Insured or Actuarial rate, whichever is less, for Kharif season and 1.5 percent for Rabi season. For commercial/horticulture crops, premium rate of 5 percent is fixed to be paid by the farmer. The difference between premium rate and rate of insurance payable by farmers will be shared by

the Central government and the State government equally as premium subsidy.

(iii) *Estimation of crop yield*: The minimum number of Crop Cutting Experiments (CCEs) required at village level is 4 for major crops and 8 for other crops. Inputs from RST/satellite imagery would also be utilized in optimizing the sample size of CCEs.

(iv) *Use of modern technology*: The CCEs have been lacking in reliability and speed in estimation of crop yield. The use of mobile based technology with GPS stamping was recommended to improve the quality of data and make faster assessment of claims. The expense in procuring handheld devices/smart phones are to be borne equally by the Centre and the State, with a cap on total funds to be made available by the Central government. The use of technology available in the fields of remote sensing, aerial imagery, satellites etc. would reduce manpower and infrastructure. It is estimated that using a mix of modern technology can be expected to minimize the number of CCEs by about 30 percent.

(v) *Role of private players*: The public sector company, Agriculture Insurance Company (AIC) of India along with other public and private insurance companies are participating in the new crop insurance scheme. The selection of Implementing Agency (IA) is made by state governments by adopting a cluster approach consisting of 15-20 'good' and 'bad districts', based on risk profile, with reference to the bid to be laid out. Selection of IA is to be made through competitive bidding upto 3 years.

(vi) *Time frame for loss assessment*: The cut-off date for the receipt of yield data is within one month of final harvest. Processing, approval and payment of final claims is based on the yield data and it is to be completed within three weeks from receipt of yield data.

(vii) *Timely release of premium subsidy to insurance companies*: The government (both Central and State) must release 50 percent share of premium subsidy to insurance companies, in the beginning of every crop season, based on fair estimates submitted by them, and settle balance of actual premium subsidy for season as soon as final figures are submitted by insurance company.

(viii) *Publicity and awareness*: Adequate publicity is to be given in all villages of the notified districts through fairs, exhibitions, SMS, short films, electronic and print media and documentaries. The crop insurance portal should be regularly uploaded with all published material information. (Ashok Gulati Prerna Terway Siraj Hussain, February 2018)

States that have notified pradhan mantri fasal bima yojana & weather-based crop insurance scheme in kharif 2016 are:

1) Bihar, 2) Gujarat, 3) Madhya Pradesh, 4) Jharkhand, 5) Uttar Pradesh, 6) Karnataka, 7) Telangana, 8) Andhra Pradesh, 9) Maharashtra, 10) Rajasthan, 11) Chhattisgarh, 12) Goa, 13) Uttarakhand, 14) Odisha, 15) Himachal Pradesh, 16) Assam, 17) Tamil Nadu, 18) Kerala, 19) West Bengal, 20) Meghalaya, 21) Tripura, 22) Haryana, 23) Manipur

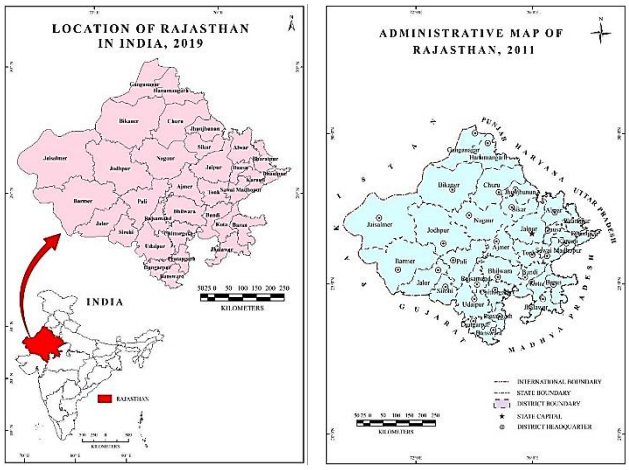
The state-run Agriculture Insurance Company of India (AIC), which has been allocated the largest number of districts under the scheme, handles insurances in other districts and states. The others are the United India Insurance, New India Assurance and Oriental Insurance, and private general insurers such as HDFC ERGO, ICICI Lombard, Reliance GI and IFFCO-Tokio. Since its implementation, the PMFBY has achieved 41-percent coverage of farmers—this may be considered impressive, particularly when compared to the 28-percent coverage of farmers achieved under the three previous schemes combined (WBCIS + NAIS + MNAIS). During its first year, 58 million farmers were enrolled in the PMFBY, a quantum jump from the 30 million insured in the previous year under the MNAIS. However, there has been a fall in the number of total farmer applicants from 58 million in 2016–17 to 47 million in 2017–18 [9-10].

There are a number of crop insurance schemes taken by the government but these schemes mostly rely on the yield factor but apart from this factor there are several other factors that need attention of the decision makers to take into account in matters of insuring a farmer against crop failure. For such task Rajasthan with its 33 districts have been selected for the study to understand the risk zones and their consequent need for crop-insurance.

MATERIALS AND METHODS

For the fulfillment of the aims and objectives of the research, secondary data based on Census 2011, Rajasthan Agricultural Statistics at glance, 2017-18, Statistical Abstract of Rajasthan, 2015, Groundwater Yearbook, Rajasthan, 2020-21, Rajasthan government websites, e-journals, books etc. has been collected and tabulated for 2016-17 by selecting 9 indicators for risk assessment. The indicators include average annual rainfall, deviations of rainfall, per cent area under saline and alkaline soils per net sown area, yield, intensity of cropping and irrigation, average size of holding and ground water table depth. These nine indicators are further categorized into zones of high, medium and low risk to assess a composite index.

Each individual district is further given a score for each indicator, 0 for low, 1 for medium and two for high. And finally, a composite score is calculated for every district and resultant maps are prepared with the help of Arc GIS software. The data is analyzed and interpreted for each variable and results are discussed with suggestions.



Study area

The state of Rajasthan is located in the northwestern part of the Republic of India. It is the largest state covering an area of 3,42,239 square kilometers, bounded by 23°30'North and 30°11'North latitude and 69°East and 78°East longitude. The state shares its west and northwestern boundary with Pakistan which is about 1070 km. Gujarat and part of Madhya Pradesh on its south, rest of Madhya Pradesh and Uttar Pradesh on its east and Punjab and Haryana on its north and northeast. The state occupies 10 percent of the total geographical area of the country, but the vast geographical area commands only 1 percent of the total water resources in the country. Agriculture is mainly rain fed but it is inadequate and aberrant. As per 2011 census Rajasthan has population of 68,621,012 people. Hindus account for 92 per cent of the population. The state is divided into 33 districts for administrative purposes. About 73.15 per

cent constitutes rural population and it has literacy rate of 66.1 per cent. The tropic of Cancer passes through its southern tip in the Banswara district. This state is practically free from maritime influence. The distinguishing feature of the state is the Aravalli range the only important river in west Rajasthan is the Luni or Salt River (the Lonavari or Lavanavari) which rises in the hills southwest of Ajmer city and was first known as Sagarmati. It has several tributaries, the chief being the Lilri, the Raipur Luni, the Guhiya, the Bundi, the Sukri and the Jawai. May is the hottest month with the mean maximum temperature at about 41°C -42°C in the plains, the plateau regions and elevated places recording 2°C to 4°C lower. January is the coldest month in the state when the mean minimum temperature for the state as a whole is 7.4°C The total annual rainfall in state varies from14 cm over the extreme northwestern parts to 1000 cm over the southeastern parts. About 75 to 95 per cent of the total rainfall mostly precipitates in the monsoon period i.e., from June to September. The average annual Rainfall (2020) of the state is 583.13 mm. Rajasthan is pre-eminent in quarrying and mining in India. Hindustan Zinc, headquartered in Udaipur, Rajasthan is India's only and world's leading integrated zinc, lead and silver producer. Jaipur is the capital of Rajasthan with more than 3 million populations and the state economy is mainly dependent on agriculture, manufacturing and mining. Rajasthan is the major tourist state with many forts and palaces.

RESULTS AND DISCUSSION

For the fulfillment of the objectives seven indicators have been selected to analyze the spatial variations in the risk assessment and need for crop insurance. The first indicator is actual rainfall in the districts of Rajasthan.

Actual rainfall

Rainfall is a very important indicator to determine the risk of crop failure and need for crop insurance in Rajasthan where there is scarcity of monsoons. The state's rainfall pattern is inadequate and uncertain. The monsoon period is short with late onset and early withdrawal. The average rainfall is 58 centimeters, while 61 per cent of the area lies in arid and semi-arid tract. Soil in the area has poor fertility, low water holding capacity and high infiltration rate. A very large tract of land is saline and alkaline in nature. The prime concern of growing crops in the area is to meet the food requirement of the people and fodder requirement of the animals. The crops are grown under high risk due to inadequacy of water.

Table 1 Actual rainfall in districts of Rajasthan

Rainfall in millimeters	No. of district	Risk
<500	13	High
500-1000	17	Medium
>1000	3	Low

(Table 1) depicts that out of 33 districts, 13 districts of the state are falling in high-risk zone where actual rainfall fall below 500 millimeters in the western and north western part of the state, 17 districts receive medium amount of rainfall and only three districts have sufficient rainfall well above 1000 millimeters throughout the year or are in the low-risk zone in south eastern corner of the state.

Deviations from actual rainfall

Deviations from actual rainfall is truly a good indicator of risk assessment in the region as it represents the shortage of rainfall in the area as more is the deviations in the amount of actual rainfall more will be the risk. As more is the deviation more will be the shortage of rainfall in the area. (Table 2) represents the amount of deviation from actual rainfall in the district in percentage. It can be observed from the table above that although there are only 5 districts which fall under low risk of deviations more than 25 per cent but still there are 20 districts which are at a high-risk having deviations in rainfall to less than 0 since they have constant decrease in amount of rainfall with many having negative values. This itself indicates that predominantly there is an annual shortage of rainfall in the area which is posing risk of crop failure [11].

Table 2 Deviation of actual rainfall in districts of Rajasthan, 2016-17

Deviations in %	No. of district	Risk
<0	20	High
0-25	8	Medium
>25	5	Low

Per cent area under saline soil (ha) per net sown area

Rajasthan being geographically the largest state in the country has a varied topography where soils differ in quality depending on the organic matter present in them, their physical structure, local climatic variation, the crop rotation cycle that is followed, availability of moisture etc. The nutrient carrying capacity of soils varies not only within the district but also village to village and even farm to farm. Soils of the state have low microbial activities and poor soil organic carbon due to which more than 75% soils of the state are not in good health. Deficiencies of nitrogen, phosphorous, sulphur, zinc and iron are quite common. The wide differences in land productivity indicate the variation in soil health across districts in the state which will turn has an impact on crop yields and significantly crop failure. A large tract of land is saline and alkaline soil. The area under saline soil to the net sown area in per cent is calculated and shown in (Table 3). It was observed that though there are lesser area under saline soils in the state with respect to the net sown area but it will pose a risk to cropped area in the near future. There are six districts which have more than 5 per cent area as saline and 19 districts with less than 3 per cent area as saline.

Table 3 Area under saline soils per net sown area in districts of Rajasthan, 2016-17

Area in per cent	No. of district	Risk
<3	19	Low
3-5	8	Medium
>5	6	High

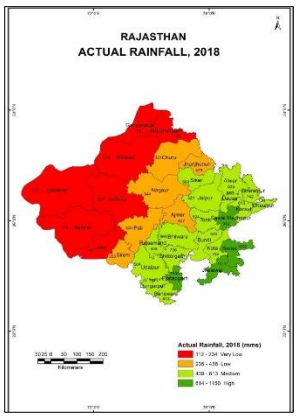
Table 4 Area under alkaline soils per net sown area in districts of Rajasthan, 2016-17

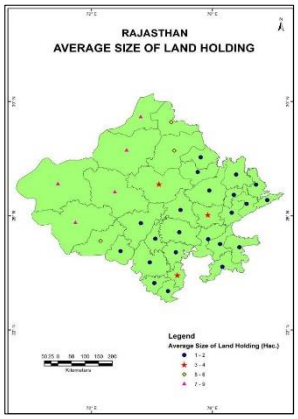
Area in %	No. of district	Risk
<3	15	Low
3-5	8	Medium
>5	10	High

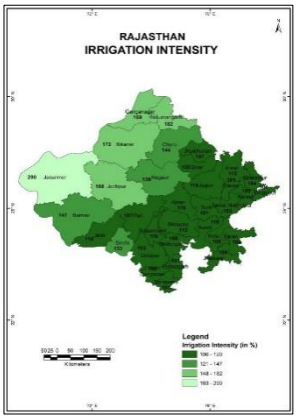
Per cent area under alkaline/sodic soil per net sown area

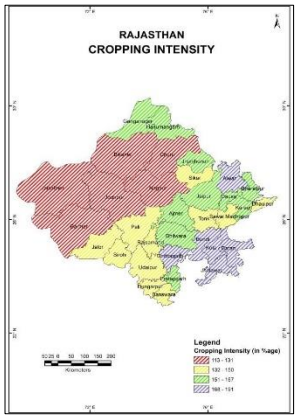
Alkalinity impairs plant growth by restricting water supply to the roots, thus obstructing root development. It results to phosphorus and zinc deficiencies, and possibly iron deficiency and boron toxicity. Plants have less ability to extract essential nutrients from the soil when damaged by alkalinity. Hence more is the area under alkaline soils more it will impact the crops and may cause nutrient deficiency and in the near future may lead to crop failure or reduction in crop yield

therefore it is selected as an indicator for the research. As shown in (Table 4) there are a significant number of districts (10) which have more than 5 per cent area as alkaline thus forming the zone of high-risk area with regards to crop failure.









Cropping intensity

It refers to rising of a number of crops from the same field during one agricultural year; it can be expressed through a formula. It is calculated as:

$$\text{Cropping intensity} = \frac{\text{Gross Cropped Area}}{\text{Net Sown Area}} \times 100$$

More is the cropping intensity more will be the yield of the crop and it will give more returns to the farmers. The regions with lesser cropping intensity area also the areas of low rainfall will be the zone of high risk and more in need for crop insurance. Thus, it is selected as an important indicator of ascertaining the risk assessment in the area.

Table 5 Cropping intensity in districts of Rajasthan, 2016-17

Category	No. of district	Risk
<150	17	High
151-170	10	Medium
>171	6	Low

The (Table 5) clearly shows that there are majority, 17 districts of the state with cropping intensity of less than 150 per cent are also the areas of low rainfall located in western and north- western side of the state like Bikaner, Jaisalmer, Barmer, Jodhpur etc. and only 6 districts like Bundi, Kota, Jhalawar etc. with more than 171 per cent which indicates that the region has a high risk of decrease in cropping and emphasizing the need for crop insurance.

Table 6 Yield of crops in districts of Rajasthan, 2016-17

Productivity in kg/hectare	No. of district	Risk
<1000	10	High
1000-2000	16	Medium
>2000	7	Low

Yield

Yield, the mass of harvest crop product in a specific area, is influenced by several factors. These factors are grouped in three basic categories known as technological (agricultural practices, managerial decision, etc.), biological (diseases, insects, pests, weeds) and environmental (climatic condition, soil fertility, topography, water quality, etc.). These factors account for yield differences from one region to another worldwide. The higher crop yield ensures food security and lesser risk of crop insurance. With regards to the state (Table 6) there are only 7 districts where the yield is more than 2000 kilograms per hectare as compared to the other half where the yield is less than 1000 kilograms per hectare.

The table itself indicates the fact that in majority of the districts faces lower yield output of less than 2000 kg per hectare which is a matter of concern in terms of risk and need for crop insurance.

Average size of holding

As per census definition an operational holding defined as "all land which is used wholly or partly for agricultural production and is operated as one technical unit by one person alone or with others without regard to title, legal form, size or location" is taken as statistical unit for data collection in Agriculture Census. For understanding the size of holding in the state average operational size of holding is selected as an indicator and represented in (Table 7) below.

Table 7 Average size of holding in districts of Rajasthan, 2016-17

Area in hectares	No. of district	Risk
0-3	22	High
3-6	6	Medium
6-9	5	Low

It can be observed that 22 districts out of 33 have very small size of operational holding of less than 3 hectares which indicates that majority of the districts in the state are facing high risk as lesser is the size of holding more will be the risk of crop failure and consequently more requirement of crop insurance.

Table 8 Groundwater table depth in districts of Rajasthan, 2016-17

Depth in meters below groundwater level	No. of district	Risk
0-20	19	Low
20-40	7	Medium
40-60	7	High

Average groundwater table depth

Groundwater is a critical resource for food security. Rajasthan is a deficit state with respect to groundwater as well as available irrigation water. It contains about 11 percent of total land resource of the country but the availability of the total water resource of the country is hardly 1 percent. Maximum utilization/ exploitation of these water resources has resulted in the irrigation of 32 percent of the area in the state. Cropping largely depends on irrigation as there are very few perennial

source of water. The depth of ground water table will help to access the water requirements of the state in terms of agriculture. Hence, it is selected as a very important indicator of risk assessment.

(Table 8) indicates that 7 districts are facing high risk as they have ground water level between 40-60 meters which indicates that such districts need attention in terms of availability of water for crops and fodder which will impact on the crop yield and farmers may need crop insurance.

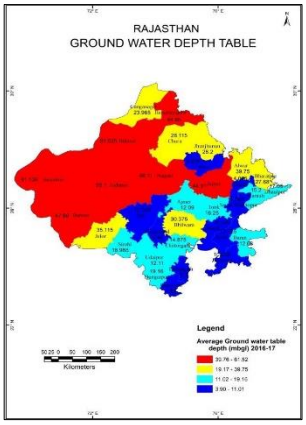
Irrigation intensity

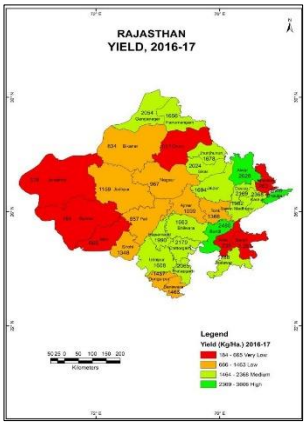
Intensity of irrigation is an important indicator to assess the risk faced by farmers as lower the intensity of irrigation (measured in terms of per cent of ratio of gross irrigated area to net irrigated area) higher will be the risk and hence need for crop insurance as it is a water deficit state with regards to surface water and rain.

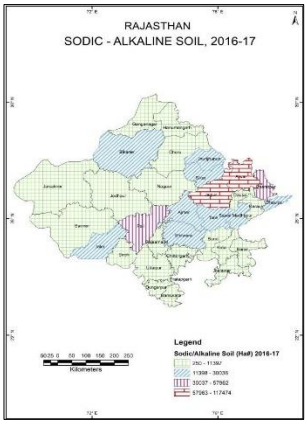
Table 9 Intensity of irrigation in districts of Rajasthan, 2016-17

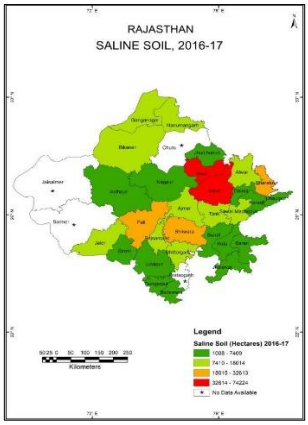
Intensity in per cent	No. of district	Risk
<120	23	High
120-140	3	Medium
>140	7	Low

(Table 9) clearly shows that a very large number of districts have a low irrigation intensity of less than 120 per cent due to insufficient rains and lack of irrigation facilities which can have an impact on crop production and thus a high risk is assessed for such districts.









Composite index of risk assessment

After ascertaining the regions of high, medium and low risk these nine indicators are given scores. Each individual district is further given a score for each indicator, 0 for low, 1 for medium and 2 for high. And finally, a composite score is calculated for every district. This score is divided into three classes to find regions of high, medium and low risk and is shown in (Table 10) below.

Table 10 Composite index of risk assessment in districts of Rajasthan

Index	Number of districts	Name of districts	Risk zones
0-5	4	Bundi, Chittorgarh, Ganganagar, Karauli	Low
5-10	24	Ajmer, Alwar, Banswara, Baran, Barmer, Bhilwara, Bikaner, Churu, Dausa, Dholpur, Dungarpur, Hanumangarh, Jaipur, Jaisalmer, Jodhpur, Jhalawar, Kota, Pratapgarh, Sirohi, Udaipur, Tonk, Rajsamand, Sawai Madhopur, Sikar	Medium
10-15	5	Bharatpur, Jalore, Jhunjhunu, Nagaur, Pali	High
Total	33		

The table shows that there are a large percentage of districts falling under medium to high-risk zones in terms of crop failure and are in utmost need for crop insurance especially districts of Bharatpur, Jalore, Jhunjhunu, Nagaur and Pali. Around 24 districts also are a need for insurance mechanism in incidences of crop failure due to unavailability of many indicators discussed above. Such districts suffer numerous problems of shortage of water, lesser cropping intensity, lesser intensity of irrigation, small size of holdings and lower yields as well.

Suggestions

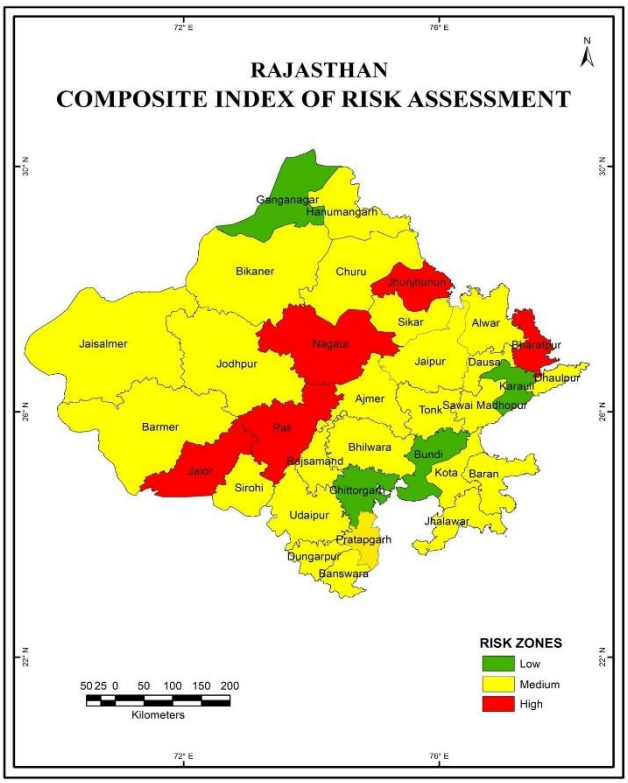
Crop insurance

The State has been implementing Weather Based Crop Insurance Scheme (WBCIS) in 20 districts and Modified National Agriculture Insurance Scheme (MNAIS) in 13 districts. Crop Insurance Scheme is compulsory for all loanee Farmers whereas it is optional for non-loanee Farmers. This Scheme is being implemented in state through Insurance Companies empanelled by Government of India. Under this Scheme, all important Kharif and Rabi Crops are notified.

According to Pradhan Mantri Krishi Bima Yojna the insurance and financial support is given to farmers during natural calamity and adverse climatic conditions. Various insurance companies are allocated different districts to cover insurance based on availability of crop yield data.

It is important to note that regions that are stuck to poverty have farmers that have the toughest challenges to face. Farmers in such areas not only have small land size holding and less income but are also prone to adversities of nature. Ignorance amongst the farmers and absence of rural agents to distribute agricultural insurance was a major hindrance to penetration in rural area. Apart from this transparent assessment of crop damage within a specified time following weather shocks and the ability to adequately compensate for the losses within the shortest possible time were also challenging. For such farmers insurance is also not an option as most of the insurance companies calculate insurance premium on the basis of yield. The policy makers should definitely incorporate other factors apart from crop yield as the basis for crop insurance to farmers like size of holding, cropping intensity, rainfall deviations and ground water depth which are almost ignored in

every policy. There is a strong need for integrated crop, integrated water, integrated nutrient management and overlooking every indicator for crop insurance and policy formulation. There is a need to work out zones of risks of crop assessment and need for insurance throughout the state. Such steps might be helpful for farmers under risk of crop failure and management.



CONCLUSION

13 districts of the state are falling in high-risk zone where actual rainfall fall below 500 millimeters in the western and north western part of the state, 17 districts receive medium amount of rainfall and only three districts have sufficient rainfall well above 1000 millimeters throughout the year or are in the low-risk zone in south eastern corner of the state. there are only 5 districts which fall under low risk of deviations more than 25 per cent but still there are 20 districts which are at a high-risk having deviations in rainfall to less than 0 since they have constant decrease in amount of rainfall with many having negative values. There is presence of alkaline and saline soils in the region though not much significant in terms of areal extent but it will surely put stress and increase risk of crop failure in the region. 17 districts of the state with cropping intensity of less than 150 per cent are also the areas of low rainfall located in western and north-western side of the state like Bikaner, Jaisalmer, Barmer, Jodhpur etc. and only 6 districts like Bundi, Kota, Jhalawar etc. with more than 171 per cent which indicates that the region has a high risk of decrease in cropping and emphasizing the need for crop insurance. There are only 7 districts where the yield is more than 2000 kilograms per hectare as compared to the other half where the yield is less than 1000 kilograms per hectare which shows that yield should be considered as an indicator for risk assessment and need of crop insurance in the state. The region dominates in small size of landholdings of less than 3 hectares of land that enhances a high risk and need for crop insurance. With maximum number of districts using ground water as major source of irrigation and lack of other technological measures like drip irrigation or sprinkler irrigation and a meager area under canal irrigation in the area, the ground water table depth has been recorded between 40-50 meters. This trend if continues there will be an acute shortage of water in near future and will pose a high risk of crop failure in the state. The composite score worked out also indicates that there are a large percentage of districts falling under medium to high-risk zones in terms of crop failure and are in utmost need for crop insurance especially districts of Bharatpur, Jalore, Jhunjhunu, Nagaur and Pali. Around 24 districts also are a need for insurance mechanism in incidences of crop failure due to unavailability of many indicators discussed above. Such districts suffer numerous problems of shortage of water, lesser cropping intensity, lesser intensity of irrigation, small size of holdings and lower yields as well.

LITERATURE CITED

1. Hazell, P., Pomareda, C. and Valdes, A. (1987) article in southern economic journal in Corp insurance for agricultural development.
2. Kiran, A.S, Umesh, K.B., and Jamakhandi, B.R (2011) “Crop insurance – A instrument of Agricultural Development” Indian journal of agricultural economics. DOI: 10.22004/ag.econ.210867
3. Birari, K.S., Nawadkar D.S. and Kassar D.V. (2002) Crop insurance scheme as a livelihood security in rain-fed agriculture in western Maharashtra. Agricultural Economics Research Review, (Conference Issue): 63- 69.
4. Ardhanareeswaran K.N. (1985) Crops insurance- A boon. Yojana, 29: 4-5.
5. Raju, S.S. and Chand, R. (2008) A Study on the performance of national agricultural insurance scheme and suggestions to make it more effective. Agricultural Economics Research Review, 21: 11-19.
6. Manoj K., Sree kumar B. and Ajith K. (2003) A case study of banana farmers in Wayanand district. Agricultural Economics Research Review, 54: 1-56.
7. Gaulati A., Terway P., Hussain S. (2018) “Crop insurance in India: Key issues and way forward” indian council for research on international economic relations.
8. Nair R. 2010. Crop insurance in India: Changes and challenges. *Economic and Political Weekly* 45(6):
9. Ruchbah Rai, 2019 “Pradhan Mantri Fasal Bima Yojana: An Assessment of India’s Crop Insurance Scheme”, *ORF Issue Brief No. 296*, May 2019, Observer Research Foundation.
10. Singh, G. (2010) Crop Insurance in India. Indian Institute of Management, Ahmedabad. Research and Publications. esocialsciences.com
11. Sinha S, Tripathi NK. 2014. Assessment of crop insurance international practices, policies and technologies as risk mitigation tools in India and Thailand. *International Journal of Advanced Research* 2(9):769-789.