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Revamping Crop insurance in India: Empirical evidence from Karnataka and insights from abroad

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Abstract
Farmers are in the scourge of an agrarian crisis. The major risk mitigation tool available for farmers is 'crop insurance'. Unfortunately the concept of crop insurance has been a failure in India as in the year of peak performance of a crop insurance scheme (PMFBY) only around 35 per cent of the total arable land area is insured. Results from the study in Karnataka shows that less than 50 per cent of economic loss of farmers was compensated by PMFBY. Regression analysis indicated that claim payment had a significant impact on farmers' coverage but claim payment has been faulty. Thus to improve the crop insurance products of India, review of crop insurance products of USA, China and Philippines were done. Taking insights from these a revenue based crop insurance model has been suggested as in USA to cover both the shortfalls in crop yield and price to increase the welfare of Indian farmers.

Keywords: Crop insurance, PMFBY, claims, risk, price, farmers insured

Introduction
India is in the scourge of an agrarian crisis. Erratic rainfall, climate changes, crop failures, indebtedness, non-remunerative prices and meager benefit over cost of all the crops have led to the misery of farmers in the farm sector.

Crop production is vulnerable to many kind of risks such as variability in climate and price, pest and diseases *etc*. Hence crop production is prone to crop failures more often than not in Indian conditions and with other plethora of reasons like seasonality of crop production, unemployment, non-remunerative prices for agricultural products, fragmented land holding, lack of education; crop failure is a major cause for poverty in India.

Risk and shocks are chronic for farmers around the globe. In developed countries, farmers usually opt for insurance and other financial instruments (like futures and options) to safeguard themselves from shocks. Unfortunately, access to these kinds of formal financial risk management products is very limited in most rural areas of developing countries. For instance, only 32 % of the farmers are insured during Kharif 2016 in India as against more than 90% in USA.

Farmers in developing nations regularly use risk mitigation approaches like relying on low risk/yield production practices, which can have adverse livelihood consequences which lead to poverty in the long run (Rosenzweig and Binswanger 1993; Morduch 1995) [15, 5].

Also, when shocks like droughts occur, farm households in rural areas have been observed using coping approaches that comprise selling off their productive capital, skipping meals, withdrawal of their children from school (Janzen and Carter 2013) [6]. Therefore, the danger of shocks (i.e., risk) and the approaches used to deal with them play a critical role in the long-term wellbeing of these farm households.

Insuring the crops and livestock plays a huge role in reducing poverty in India as it provides assured income in times of crop failure and catalyzes the production after a bad agricultural year (Raju and Chand, 2008) [12].

The mechanism to provide these insurance has failed miserably in India adding to the woes of farmers. Hence reviewing the crop insurance policies would do a lot well in the process of reducing the poverty in rural areas.

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Formal insurance i.e., insurance provided by an insurance company, of any kind is a rarity among the poor. Health insurance, insurance against inclement weather, and insurance against the death of livestock, which are standard products in the lives of farmers in rich countries, are seldom present in the developing countries (Banerjee and Duflo, 2011) [1].

There are many difficulties in providing insurance; these are not specific to the poor. They are fundamental problems and they are only highlighted in poor countries, where it is difficult to monitor the insured. For instance moral hazard, People might spend higher proportion of their income on healthcare and so forth by farming less carefully once they realize that they will not bear the consequences fully (Banerjee and Duflo, 2011) [1].

The objective of this piece of research is to evaluate the performance of crop insurance schemes in India and to review crop insurance products across the globe so as to take critical insights from those to increase the welfare of farming community.

Data and methodology

Primary data from the sample farmers were collected with pre-tested schedule through personal interview method. The information regarding the basic details of the sample farmers *viz.*, socio economic characteristics, crop enterprises, cost of cultivation, quantity and prices of outputs for crops and livestock enterprises were collected. Also, information on farmer's borrowings, amount of premium and indemnity, knowledge about PMFBY, constraints faced in availing PMFBY, suggestions to improve the present scheme, etc., were collected.

Secondary data on number of farmers covered, area covered, premium collected, sum assured and claims settled were obtained from the India stat database and many other published sources.

The multistage random sampling technique was used in selection of districts, taluks, villages and farmers for the study. In the first stage, two districts namely Bidar and Koppal were selected from two agro climatic zones, Zone 1 and Zone 3 based on the agro-climatic conditions mainly annual rainfall where Bidar has the highest normal rainfall of 876mm and Koppal having lowest of 598mm (DES, 2017). Similarly, in the second stage, 2 taluks were selected randomly from the selected districts. In the third stage, 2 villages were selected randomly from each of the selected taluks. In the final stage, 15 farmers each from one village were selected randomly. Among 15 farmers, 10 were insured (crop insurance - availed) and 5 (crop insurance - not availed) were non-insured. Among 10 insured, 5 were loanee and 5 were non-loanee farmers. Thus, the sample size constituted of 60 for each district and 120 for the study as a whole.

A multiple regression analysis was done with total farmers covered as dependent variable and other explanatory variables such as claims, consumer price inflation (food) and rainfall. The equation is as follows

$$y_t = a + b_1 x_{1t} + b_2 x_{2t} + b_3 x_{3t} + b_4 x_{4t} + b_5 x_{5t} + u_t$$

Where,

y_t is farmers insured in year 't'

x_{1t} is the claims received in year 't'

x_{2t} is the claims received in 't-1'th year

x_{3t} is the consumer price inflation (food) in year 't'

x_{4t} is the percentage to normal rainfall in year 't' and x_{5t} in year 't-1'

Crop insurance at global level

The US Congress introduced the Federal Crop Insurance Program (FCIP) in 1938 to assist farmers recuperate from the Great Depression and the Dust Bowl. Different types of crop insurance policies offered to farmers in the USA are Crop hail policy and Multi-peril crop insurance (MPCI). Crop hail policy is directly provided to farmers by private insurers and it is not under the FCIP. The farmers purchase this policy where crops are affected by frequent hailstorms. The policy can be purchased at any time of the agricultural season. Multi-peril crop insurance (MPCI) is monitored and regulated by Risk Management Agency (RMA). This is a Public Private Partnership (PPP) programme and 19 private companies are currently authorized by RMA to write MPCI policies. These policies cover the loss in yield due to extreme weather conditions and price risk to protect farmers against potential loss in income. The crop insurance products consist of individual as well as area plans. There are mainly two types of policies quantifying losses in the US. Revenue policies which protect against shortfalls in revenue due to low crop yields, lower-than-expected crop prices at harvest, or both and yield policies which protect against losses due to low crop yields only. Revenue policies are more popular among agricultural producers, accounting for about 80 percent of all policies offered through the program and about the same percentage of total premiums in 2016 (CBO, 2017) [3].

Chinese agricultural insurance is well-known for its quick success and effectiveness. 170 types of insurance products for almost all crops, livestock and forest were offered by 26 insurance companies during 2016. At present multi-peril, index-based, price index and indemnity-based insurance products are available to insurers. A pilot program on revenue insurance was started by the Chinese government during 2016-17 (Krychevska *et al.,* 2017) [7].

From major crops, high-value commercial crops to livestock, fishery, even non-crop farm assets to term insurance packages, there are seven product lines available under the Philippines Crop Insurance Corporation (PCIC). The insurance program provides security to farmers against damages of their non-crop farm assets such as warehouses, mills, irrigation structures and other farm equipment due to perils like fire, lightning, earthquake and even theft (PCIC, 2014; Cajucom, 2013) [10, 2].

The term insurance packages of Philippines - Agricultural Producers Protection Plan is "insurance protection that covers the death of the insured due to the accident, natural causes and murder or assault". Loan Repayment Protection Plan is an "insurance protection that assures the repayment of the approved agricultural loan in case of death or permanent disability of the insurer". Accident and Dismemberment Security Scheme meanwhile, is an "insurance protection that covers death or disablement of the insured due to accident" (PCIC, 2014) [10].

In Philippines, banks are made to share a part of the premium burden of farmers. For rice the premium is 10.81 per cent and the banks are made to pay 2 per cent of the premium. Similarly to incentivize farmers' participation in the PCIC premium discounts are given for group coverage of farmers like a 5 per cent discount is given to the group of 15-25 members, 10 per cent discount to the group of 26-40 and 15 per cent discount to a group of more than 40 members. These discounts encourage farmers to insure their land as a group

and cultivate as a group. At present in the Indian situation this might help in achieving two objectives, one in increasing the area under crop insurance and two to promote co-operative farming. Further, holistic cover of all risks related to agriculture is under one roof. From crop insurance to non-crop farm assets to life insurance of farmers.
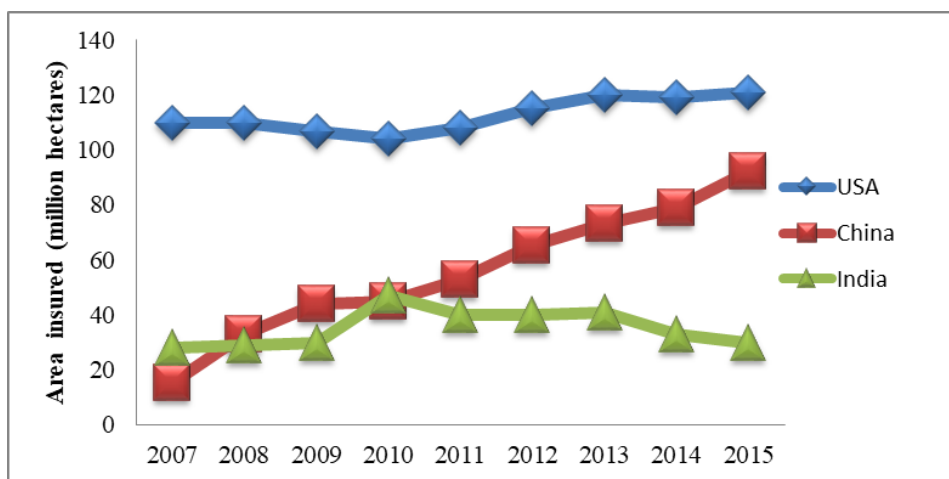
Crop insurance in India

Table 1: Crop insurance products and their features in India

Insurance scheme	Period	Approach	Crops covered	Salient features	Limitations
Crop Insurance Scheme	1972-78	Individual	H-4 Cotton, groundnut, wheat, potato	Voluntary Implemented in 6 states	Non viability due to high claims ratio and administrative costs. Non popularity.
Pilot Crop insurance scheme	1979-85	Area	Cereals, Millets, oilseeds, Cotton, potato, chickpea	Confined to loanee farmers, voluntary. Pilot in 12 states.	Small farmers couldn't participate - poor access to institutional credit.
Comprehensive Crop Insurance Scheme	1985-99	Area	Food grains and oilseeds	Compulsory for loanee farmers	Coverage capped at □ 10000 per farmer.
Experimental Crop Insurance Scheme	1997-98	Area	Cereals, pulses and oil seeds	Covered non-loanee, small and marginal farmers also. Implemented in 5 states.	High administrative costs. High financial burden to the union government.
National Agricultural Insurance Scheme	1999-00	Area and Individual	All crops	Available to all farmers. 10 per cent premium subsidy to small farmers.	Private companies not involved. Prevented sowing and post-harvest losses not considered.
Farm Income Insurance Scheme	2003-04	Area	Wheat and Rice	Insurance against production and market risks.	High administrative costs and lack of infrastructure to assess losses accurately.
Weather / Rainfall Insurance	2003-15	Individual	All crops	Available to all farmers. Based on rainfall received at the IMD / block rain gauges.	Distance of the field from weather stations. Basis risk is high due to poor density of weather stations.
Modified National Agricultural Insurance Scheme	2010-15	Area and Individual	All crops	Unit area reduced to village /village panchayat level. Private companies involved.	Less coverage of farmers. Delay in claim settlement.
Pradhan Mantri Fasal Bima Yojana and Restructured WBCIS	2016 onwards	Area and individual	All crops	One season one premium rate. Mandatory use of smart phones, RST and drones for rationalization of CCEs.	Delay in claim settlement due to delayed payment of premium subsidy to insurance companies by the government. Lack of adequate AWS. Less coverage of tenant farmers.

Source: Authors compilation from various sources
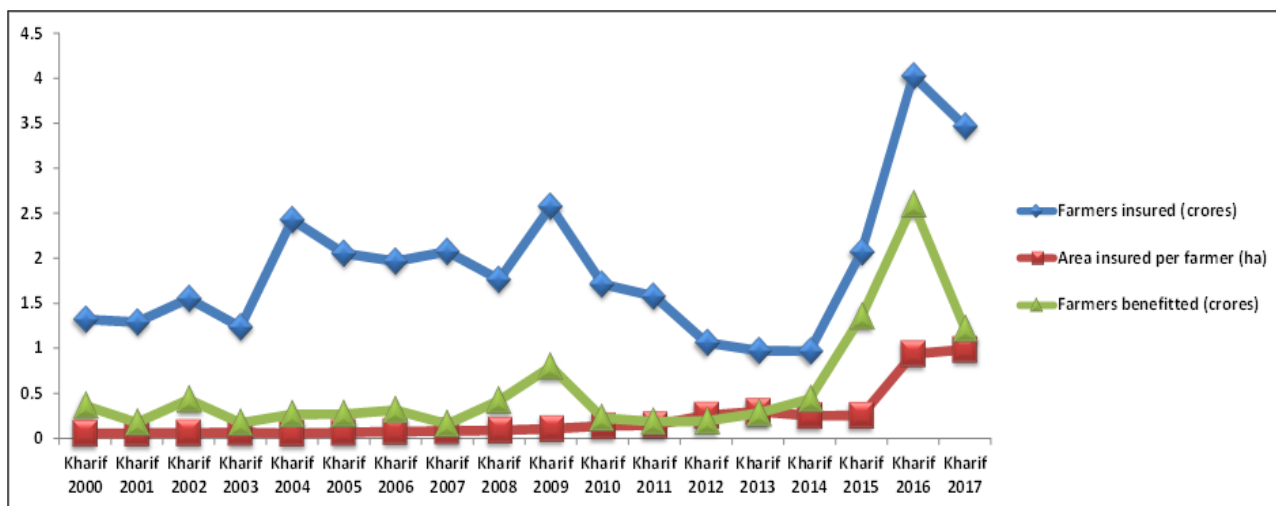
Results and Discussion

Source: Authors calculation based on data from various secondary sources

Fig 1: Area insured under crop insurance in different countries

China had 3 times (92 mha) and USA had 4 times (121 mha) of area under crop insurance as compared to India (30 mha) in 2015. Around 80 per cent of the total arable land is covered under crop insurance in USA whereas in spite of increase in area coverage under PMFBY (55.1 mha during *kharif* and *rabi* 2016-17), only around 35 per cent of the total arable land area is insured in India. Thus, it is high time to review the product design of the crop insurance products available and bring necessary changes in the implementation of the scheme.
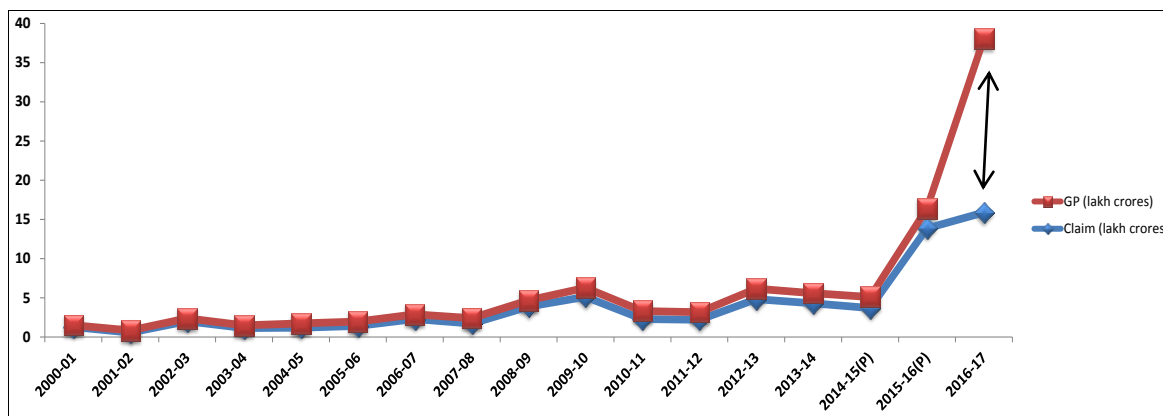
Is PMFBY a game changer?

Fig 2: Area insured, farmers insured and benefitted during Kharif seasons (2000-2017)

Kharif 2016 had seen the highest ever area insured, farmers covered and benefitted in the history of crop insurance in India (Fig 2). Use of RST, picture based loss identification, less premium rates *et cetera*in the operational guidelines of Pradhan Mantri Fasal Bima Yojana (crop insurance program) and advertising played a crucial role in enrolling large number of farmers.

PMFBY has also reached a new high (Fig 3) of increased gap between gross premium collected and claims paid widening the new scheme from reaching to the farmers. Historically, correlation between claims paid and farmers enrolled showed that there was a high positive relationship (0.8) between claims paid and farmers' enrollment in crop insurance. The effect of this was realized in Kharif 2017 where the number of farmers benefitted fell to less than what was there during Kharif 2015 (NAIS). More than 84 lakh farmers withdrew from the scheme during 2016-17 and 2017-18. This also means that the private insurance companies have benefitted tremendously since the inception of PMFBY. The profit of crop insurance companies of 2016-17 alone was approximately Rs. 6459 crores.

Fig 3: Premium collected and Claims paid in during 2000-2016

States like Karnataka, Gujarat, Odisha, Maharashtra and Rajasthan have declared drought since October 2018 and have sought central assistance upto ☐ 15,500 crore (Livemint). This could be called as a proxy for the failure of PMFBY in the country. Further, a regression analysis was done to know the factors affecting farmers' enrollment using secondary data during 2000-01 and 2016-17 (Table 2). The results indicate that claims paid in the present year and in the previous year have significantly influenced the farmers' enrollment. Another variable (CPI – Consumer Price Inflation (food)) was added to know if it has any effect on farmers' insurance coverage. The coefficient of this variable had a negative sign (-0.198) indicating that if the CPI increases, farmers enrollment decreases significantly. Higher the CPI, prices of other goods are inflated, it had a direct bearing on farmers disposable income and farmers will be left with less working capital to buy crop insurance. Percentage to normal rainfall variable was also added to know the effect of deviation in rainfall, but it had no significant impact on farmers' coverage. The results of this regression analysis on a whole shows that climatic factors (like rainfall) or macroeconomic indicators (like CPI) has lesser effect as compared to direct revenue factor which compensate the losses of farmer (claims). Hence, mechanism to evaluate the losses as earlier as possible and to pay the claims timely only will increase farmers' coverage in the present scenario.

Table 2: Factors affecting farmers' coverage under crop insurance during 2000-01 to 2016-17

Dependent Variable: Farcovered				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	61.66812	153.1593	0.402641	0.6957
CLAIM	18.39660	3.755893	4.898063	0.0006
CLAIM(-1)	19.28739	4.560482	4.229243	0.0017
CPI	-0.198271	0.068385	-2.899350	0.0159
RF	0.859022	0.989557	0.868087	0.4057
RF(-1)	0.223512	1.082697	0.206440	0.8406
R-squared	0.944085	Mean dependent var		198.3075
Adjusted R-squared	0.916128	S.D. dependent var		110.5935
S.E. of regression	32.02863	Akaike info criterion		10.05113
Sum squared resid	10258.33	Schwarz criterion		10.34085
Log likelihood	-74.40907	Hannan-Quinn criter.		10.06597
F-statistic	33.76873	Durbin-Watson stat		1.957950
Prob (F-statistic)	0.000006			

Source: Authors calculation based on data collected from various secondary sources

The crux of any crop insurance scheme is to minimize the risk in production and stabilize farmers' income in times of distress or shock. To determine the extent of risk minimization under PMFBY, indicators like economic loss of sample farmers - was calculated by multiplying the yield loss (farmers expected yield – actual farm yield) of different crops by the respective average price received by the farmers for their crop during *kharif* 2016 in the study area – and claims received under PMFBY was used. Claims to economic loss ratio indicated the extent of risk reduced by PMFBY.

On an average, 52 per cent of risk per acre in Zone 1 (Bidar) and 40 per cent of risk per acre in Zone 3 (Koppal) was reduced by PMFBY during *Kharif* 2016 (Table 5).In other

words, 52 per cent and 40 per cent of the economic loss of farmers in Zone 1 and Zone 3 respectively was compensated by indemnity paid under PMFBY in the study area.

Overall, PMFBY has been able to reduce around half of the yield risk of farmers in the sample area. It has not been able to completely reduce the production risk of farmers because of the fact that PMFBY only covers shortfall in yield and not shortfall of revenue. It is suggested to take clue from the Federal crop insurance programme of USA, where the revenue shortfall is insured arising because of either shortfall in yield or fluctuation in prices, could be a game changer for modern crop insurance products in India.

Table 3: Zone-wise extent of risk reduction under PMFBY (per acre)

Crop	Premium (□)	Expected yield (Qtls)	Actual Yield (Qtls)	Yield loss (Qtls)	Price (□/Qtl)	Economic loss (EL)(□)	Claims received (CR) (□)	Risk reduced (□)	% of risk reduced (CR/EL)*100
Zone 1									
Bajra	216	10.51	4.63	5.88	1840	10819	9500	-1319	88
Jowar	248	8.98	3.00	5.98	1867	11165	8120	-3045	73
Black Gram	224	4.83	1.13	3.70	3077	11385	6013	-5372	53
Green Gram	288	5.00	1.56	3.44	3470	11937	3006	-8931	25
Soya bean	264	6.39	4.20	2.19	2443	5350	4121	-1229	77
Tur	328	8.49	1.63	6.86	3653	25060	8747	-16313	35
Average	261	7.37	2.69	4.68	2725	12739	6584	-6155	52
Zone 3									
Bajra	216	9.88	4.33	5.55	1586	8802	5762	-3040	65
Green Gram	288	4.14	0.50	3.64	3547	12911	0	-12911	0
Maize (RF)	352	14.32	7.32	7.00	1294	9058	6380	-2678	70
Maize (Irrigated)	440	17.01	9.49	7.52	1302	9791	8800	-991	90
Paddy	656	24.00	13.75	10.25	1428	14637	6720	-7917	46
Sunflower (Irrigated)	272	7.25	3.25	4.00	2168	8672	3280	-5392	38
Tur (Rainfed)	328	4.50	1.50	3.00	3640	10920	4100	-6820	38
Average	365	11.59	5.73	5.85	2138	12510	5006	-7504	40

Note: EL = Yield loss*Price, Risk reduced = Claims received – Economic loss
Source: Authors calculation based on primary data

A case of missing insurance
An irrigated onion grower from Dambralli village of Koppal district (Karnataka) had a very good yield but wasn't happy about it because of the huge losshe had incurred. Good yield and loss at a time?

The price realized during 2015 by the farmer was Rs. 4100 per quintal and in 2016 it was Rs. 840 per quintal of onion. The poor farmer has no other option than selling the crop at such low price (Distress sale). The farmer lost Rs. 3260 per quintal on previous year price and Rs. 414 on average price of 2016.

The farmer had insured his crop under PMFBY. Crop insurance couldn't cover the poor farmers losses as his "crop" was insured not the price he would realize or the income. When enquired about the enrolment under crop insurance for the next season, the farmer firmly refused as he was not happy with the policy.

The inability of the crop insurance policies to cover the price risk of the farmers is a major reason along with non-transparent, delayed claim settlement for the failure of the concept of crop insurance in India.

To assure constant income even in times of shocks like crop

failure or price fluctuation, the income of the farmer should be insured instead of the crop yield taking clues from the federal (US) crop insurance programme.

Conclusion
The main source of income for small and marginal farmers in India is through agriculture. The annual family expenditure of a farm household depends on this agriculture income. Crop failure or disease to a livestock directly decreases the income of the farmer which further leads to poverty. Hence insuring the income of the rural farm households plays a defining role in rural poverty alleviation.

Risk is inherent in agriculture, may it be price risk, yield risk or marketing risk. Crop insurance is the major risk mitigation strategy available for farmers and from soon after the independence the union government of India has been trying to implement different crop insurance products but the product design of these crop insurance products has failed miserably in insuring the farmers. The major issues which has led to the failure of crop insurance in India are, lack of reliable long term data on crops yields and crop losses, prevailing land tenure and land record systems, lack of trained personnel, lack of awareness among the farmers and faulty product design.

Thus, it is suggested instead of insuring the yield of crops, the revenue (Price x Yield) of the farmer must be insured like in USA. Use of drones, remote sensing technology, GPS, satellite imaging *et cetera* should be made compulsory (in the field) to assess the crop losses accurately along with timely settlement of claims.

Before announcing ambitious schemes proper process evaluation should be done to foresee the capacity building process like availability of technology and manpower required to implement and run the program smoothly.

Further more and more farmers, tenant farmers should be brought under insurance by doling out discounts for group coverage of farmers like in Philippines where 20 per cent discount in premium is given for a group of 5-10 farmers, 30 per cent for a group of 10-20 and 40 per cent for a group of >20 farmers.

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