Design of Weather Index Insurance for Cereals Heavy Rain Disaster

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Materials and Methods

Weather Index Insurance

Use the rainstorm disaster weather index FI to describe. Defines the occurrence of a rainstorm disaster when the magnitude of a single-day rainstorm during the grain growth period is greater than or equal to 80mm，The rainstorm index formula is shown in (1):

$$FI = R_i \qquad R_i \geq 80 \qquad （1）$$

In formula (1), FI represents the rainstorm weather index，R_I means daily rainfall.

Pure premium rate

The pure rate formula is:

$$R = E[Loss] = \sum_{i=1}^{n} x_i p_i \qquad （2）$$

In formula (2), R is the pure rate, Loss is the food loss rate, E[Loss] is the loss expectation, xi is the yield reduction rate corresponding to the i-th level of rainstorm event, and pi is the probability of occurrence of the i-th type of event.

$$P = R / (1 - E - M) \qquad （3）$$

In formula (3), R is the pure rate, E is the rate surcharge, and M is the profit surcharge.

Index insurance contract design

Index insurance contract design:

$$I = \begin{cases} 0 & D > D_c \\ x*Q & D \leq D_c \end{cases} \qquad （4）$$

In formula (4), I is the compensation amount, x is the rate of production reduction, Dc is the trigger condition, and Q is the insurance amount. When the rainfall D on the day is greater than or equal to the trigger condition set by the insurance, the insured can receive compensation.

Results

index-disaster loss model establishment

Taking Fuqing County as an example, the corresponding relationship between the rainstorm index and the yield reduction rate is shown in Table 1.

Table 1 The relationship between the rainstorm index and the grain yield reduction rate

FI	Interval reduction rate(%)	Average yield reduction rate(%)
1≤FI＜2	0.71~1.48	1.1
2≤FI＜3	1.48~2.25	1.87
3≤FI＜4	2.25~3.02	2.64
4≤FI＜5	3.02~3.79	3.41

Determination of insurance premium rate

Table 2 Example of the determination of the grain rainstorm disaster rate in Fuqing County

Area	FI	R（%）	E（%）	M（%）	Insurance rate（%）
Fuqing	1	1.70	20	20	2.83
Fuqing	2	1.40	20	20	2.33
Fuqing	3	0.83	20	20	1.38
Fuqing	4	0.67	20	20	1.12

Determination of insurance premium rate

Table 3 Different trigger conditions, rates and premiums in Fuqing County

FI	Rate（%）	Premium（Yuan）	Probability（%）
2	2.33	47	52.1
3	1.38	28	22.9
4	1.12	22	16.7

Table 4 The trigger conditions and compensation amount of Fuqing heavy rain disaster insurance

FI	Payout ratio（%）	Amount of compensation（yuan）	Triggering conditions(FI)
2≤Dc＜3	1.87	37.4	2
3≤Dc＜4	2.64	52.8	3
4≤Dc＜5	3.41	68.2	4
5≤Dc＜6	4.18	83.6	5

Take Fuqing insurance products as an example, If the insured chooses the contract trigger condition with FI as 3, after paying the premium of 28 yuan,if the rainstorm index is greater than or equal to 3 (that is, the single-day rainfall is greater than 250mm or three times of 80-120mm, etc.), then You can get insurance payments of 52.8 yuan, 68.2 yuan or 83.6 yuan per mu.

Conclusion

In this paper, according to the heavy rain disasters during the growth period of food crops in Fujian Province, the rainstorm disaster index insurance products of the representative counties in the province are designed. The insurance period of the food crop rainstorm disasters is comprehensively considered, and the rates are scientifically determined in combination with different risk areas, and insurance products are designed. It provides a scientific basis for Fujian Insurance Company to develop food crop weather index insurance.

References

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