The Integration Effect of the Corn Technology That Saves Water and Combats Drought in the Northeast Half Arid Area

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Abstract: Based on the field test and through the technical integration of saving water and combating drought about the limited water supply and the ridge culture area field, this article conducted the research on the influence of our country's northeast half arid area on the corn output. It establishes a two-experiment-factor-quota-relation model which relates the corn output and the limited water supply and the ridge culture area field after the examination. The result indicates that the water supply and the area field technology integration in the definition horizontal sector scope may control and forecast the output goal and so on. The technology of saving water cultivation for the northeast half arid area corn provides the quantitative combination plan which may regulate its factors as well as scientific basis to its local application. [The Journal of American Science. 2006;2(1):74-79].

Key words: Save water, output, model

1 Introduction

Because of the spring dry ,the soil moisture sentiment is insufficient, which seriously affects the big field crops germinates and emerges, then seriously affects crop growth and output of Northeast's half arid area in our country. Under the limited water supply, the measure of seating water and compensating water can cause the corn's earlier growth to be healthy. Therefore, seating and making up the water are effective measures that can resist the spring's dry, guarantee all buds and the strong sprout, simultaneously, also builds the good foundation for the corn later high production, stable production and the bumper crop. The ridge culture area field as an item agricultural measure of slope cultivated land conservation of water and soil, can both maintain the water and soil and enhance the soil's water content. Therefore, this experiment, with the features of making up the water and the ridge culture area field technology that saves water, conducts the technical integration effect research, and provides the scientific basis for the extension of the technology.

2 Pilot areas and the experiment introduction

This experiment carried on the " 863 " item -- " The integrated pattern and the demonstration of saving water in northeast arid, half arid area " in the model district in 2003, and the concrete testing field was located at Dongxing village, Xinglong, Gannan county, Heilongjiang Province. The Gannan county is located in the west of Heilongjiang Province, which situates on the right bank of the middle of Nenjiang River, east longitude 122° 5 ' 46 " to 124° 28 ' 12 ", and north latitude 47° 3 ' 57 " to 48° 3 ' 25 ", crossing the second and the third product temperate zone of Heilongjiang Province, the annual mean tempe ration is 2264 ℃, the annual mean rainfall amount is 455.2 millimeters, it belongs to the half arid monsoon climate. Because the spring rain is few, spring dry has become the primary factor which limits the Gannan county agriculture production. According to the investigation statistics, the Gannan county's average spring rainfall mounts to 40mm, accounting for 8.8% of the whole year rainfall, and drought actually occupies 62% of the county-wide disaster, so it has the saying of "seven drought springs out of ten".

In order to discuss the limited water supply and the area field technology integration's effect on this local characteristics and the rule, this experiment used the following design: it established 3 times of repetitions (block), 8 experimental processing, and altogether 24 experimental plots. The plots were rectangles, each 20m long, 2.6m wide, and the total area was 52m^2. Nurture 4 corn was used as the trial crop, and the dark seat hydraulic engine and the intertillage hydraulic engine, developed by Heilongjiang Province Water Conservation Academy of Science, were used to carry on sowing seeds and making up the water. After the intertillage, the build obstruct machine, developed by Northeast Agricultural University, was used to construct the area field. In corn birth period, stem height, leaf area, and lodging rate were investigated. At last, harvesting, testing plants and recording production were executed on October 7th, 2003.

3 Reduction and analysis of test results

3.1 Comparison between the influences of water supplies and area fields on corn output

The outputs of different processing plots are shown in Table 1, and F statistics examination on the data of Table 1 is shown in table 2. In Table 2, F value indicates: In the experiment, water supply is the main factor, the next main factor is the area field, while the correlation between water and the area field is not remarkable; the difference among experimental processing, water supply horizontals and area field levels is remarkable.

Table 1. Corn plot output result analytical table

Operation	Output of each plot（kg）			
number	I	II	III	T_t（kg）
1	13.44	14.39	30.67	58.50
2	26.71	22.99	35.08	84.78
3	29.44	37.61	38.41	105.46
4	47.28	37.86	42.66	127.80
5	41.04	38.40	48.34	127.78
6	53.26	42.47	54.44	150.17
7	44.64	39.50	49.57	133.71
8	62.92	46.53	58.90	168.35
T_r（kg）	318.73	279.75	358.07	965.55（T）

Table 2. Table 1 material variance analyzation

Variable	DF	SS	MS	F	$F_{0.01}$
Each of block	2	383.379			
Each of experimental processing	7	2929.969	418.567	18.83	4.28
Water supply	3	2448.143	816.048	36.70	5.56
Area field	1	465.080	465.080	20.92	8.86
Water supply×area field	3	16.746	5.582	<1	5.56
Error	14	311.270	22.234		
Total dissociation	23	3624.618			

3.2 Influence of area fields' technology measure on corn output

Because the area field factor has only 2 levels, therefore it does not have to do the examination again. From Table 1, the average yield of processed area field is 567.70 kilograms per mu, the average yield of non-processed area field is 454.77 kilograms per mu, and the average Chinese acre output increases 112.93 kilograms, the production increase rate is 24.8%.

3.3 Influence of water supply technologies measure on corn output

The q examination of the LSR law is used to compare remarkable differences of the corn yield per mu due to different water supplies, and the examination indicates: when the water supply is 12 m^3 per mu, it is superior to any other water supply amount extremely remarkably, except the difference between it and 8 m^3 per mu processing performance is not remarkable.

3.4 Influence of water supplies and area field's technology integration measure on corn output

In order to compare the difference of corn yield per mu between water supply and the area field technical integration, q test procedure of LSR law is also used to test eight operations during the experiment. The final result indicates: The best technical integration for supplying the water volume is 12m^3 per mu, simultaneously constructing the area field Operation 8. Operation 8 is remarkable or extremely remarkable in result than other operations except Operation 6.

4 Mathematical models establishment and analyzation

In this experiment, it mainly studies quota relations between variable y and two experiment factors x: water supply and the area field, and it uses two Yuan linear returns, central model to describe relations, data structural formula as following:

$$y_{\alpha} = b_0 + b_1(x_{\alpha 1} - \overline{x_1}) + b_2(x_{\alpha 2} - \overline{x_2}) + \varepsilon_{\alpha} \qquad (1)$$

Table 3. Table of each operation output and other characters in the random grouping experimental design

注　表中对于区田的两个水平，0 表示不修筑区田，1 表示修筑区田

No.	Levels of water supply	Levels of area fields	Specific operations: Water supply (m^3/mu) x_1	Specific operations: Constructing area field x_2	Yield per mu (kg) y_1	Ear number per mu (ear) y_2	Seed number of each ear (seed) y_3	Weight of a thousand seeds (g) y_4
1	1	1	0	0	250.13	1983	602	208
2	1	2	0	1	362.49	2786	603	219
3	2	1	4	0	450.91	2735	602	274
4	2	2	4	1	546.43	3128	648	272
5	3	1	8	0	546.34	3197	630	271
6	3	2	8	1	642.07	3419	663	283
7	4	1	12	0	571.70	3231	622	285

8	4	2	12	1	719.80	3812	639	296

Note: In the line of constructing area field, 0 refers to "not constructing the area field", 1 refers to "constructing the area field".

4.1 Determination of mathematical models parameters

According to table 3 , through the statistical analyzation, it may determine each coefficient b_0, b_1 and b_2 in formula (1), thus obtains the corresponding mathematical model:

Model of yield per mu： $\hat{y}_1 = 287.6918 + 27.8464x_1 + 112.9275x_2$ Ⅰ

Model of ear number per mu: $\hat{y}_2 = 2218.375 + 94.6875x_1 + 499.75x_2$ Ⅱ

Model of seed number of each ear： $\hat{y}_3 = 598.175 + 2.6375x_1 + 24.25x_2$ Ⅲ

Model of weight of a thousand seeds： $\hat{y}_4 = 224.25 + 5.875x_1 + 8x_2$ Ⅳ

The obtained various models are one regression equation, which needs a remarkable examination.

4.2 Regression equation and regression coefficient significant examination

In order to examine the model significance, first it carries on the variance analysis, then carries on the examination according to statistic F; In regression equation, each variable function may use t to examine appraises. The examination result is shown in Table 4: The model I and II is extremely remarkable, the model IV is remarkable, Model I, II and IV are credible; Model III examination is not remarkable, Model III is not suitable for this model, therefore it can not be accepted. The t examination result indicates: Regarding Model I, b_1 is extremely remarkable, b_2 is remarkable; regarding Model II, b_1 and b_2 are both extremely remarkable; regarding Model IV, b_1 is extremely remarkable, and b_2 is not remarkable.

Table 4. Regression equation and regression coefficient significant check table

Model	Model name	F test in regression equation		t test in regression coefficient		
		F	F critical coefficient	t_1	t_2	T critical coefficient
Ⅰ	Model of yield per mu	33.65	$F_{0.05} = 5.79$ $F_{0.01} = 13.30$	7.472	3.388	$t_{0.05} = 2.571$ $t_{0.02} = 3.365$ $t_{0.01} = 4.032$
Ⅱ	Model of ears per mu	32.41		6.934	4.091	
Ⅲ	Model of seeds per ear	3.96				
Ⅳ	Model of per-thousand-seed weight	9.13		4.224	0.643	

4.3 Model analysis

The limited water supply and the area field technology integration production increase effect is realized by such combined factors as ear number per mu, seed number per ear and weight of per thousand seeds. Because Model III has not achieved the remarkable level, therefore only Model I, II and IV are analyzed as the followings:

4.3.1 Output model analysis

(1) It can be seen that one time of coefficient b_1 and b_2 by the model are both just, indicating that both limited water supply and construct area field in half arid areas have obvious production increase effect, and corn's output enhances along with the increase of water supply. The t examination result in b_1 and b_2 shows that, in this experiment, under arid year condition, the production increase effect due to water supply is more obvious.

(2) Forecasting and controlling the technical integration effect can be made with the model. For example: when the water supply is under the condition of 0~12m^3 per mu, and the reliability is 0.05, from Model I, it can be forecasted that the yield per mu will be, by 95% probability, between $y' = 241.6918 + 27.8464x_1 + 112.9275x_2$ and $y'' = 333.6918 + 27.8464x_1 + 112.9275x_2$ two planes.

4.3.2 Model analysis of output constitution factor

(1) The coefficient mark of Model of yield per mu II is completely consistent with that of Model of yield per mu I, which indicates that the influence of technical integration on the output is shown mainly from ear number per mu, and this also explains that the water supply and the ridge culture area field technical integration is under the condition of reaching the proper level of Chinese acre ear amounts. The t examination result in b_1 and the b2 shows that under this experimental year the water supply and the area field are both obvious to the Chinese acre ear number effect.

(2) From the weight of a thousand seeds model IV, the effect of supplying water on the output can also reflect from the weight of a thousand seeds, displaying that proper increase of water supply can raise the weight of a thousand seeds; the weight of a thousand seeds is enhanced along with the water supply horizontal enhancement. While the t examination result of b_2 shows, under this experimental year, the area field is not obvious to the weight of a thousand seeds effect.

5 Conclusions

5.1 Different horizontal water supplies and the area fields technology integration has a great influence on the corn output and the output constitution factor, theoretically speaking, there are many kinds of supplying water and the area field combination. In order to achieve certain output goal, combined the local existing productivity level, when machinery is used to get water sowing seeds, make up the water and construct the area field, the processing 8, in which the water supply was 12m^3 per mu and the area field were built, supplied the reference.

5.2 Corn's output are usually realized through the output constitution, therefore the first goal for technical integration should guarantee the reasonable Chinese acre ear number, and in the meantime, good ear number of seeds and the weight of a thousand seeds are needed as well.

5.3 Besides the seed number per ear model, other models established in this experiment all reached remarkable or extremely remarkable level, therefore it is credible, which shows that water supply and the area field technical integration in confined horizontal sector scope may control and forecast the goals such as output.

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