THE RELATIONSHIP BETWEEN MONTH DISEASE INCIDENCE RATE AND CLIMATIC FACTOR OF CLASSICAL SWINE FEVER

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Abstract: The Swine Fever is a kind of acute, highly infective epidemic disease of animals; it is name as Classical Swine Fever (CSF) by World animal Health organization. Meteorological factors such as temperature, air pressure and rainfall affect the epidemic of CSF significantly through intermediary agent and CSF viral directly. However there is significant difference among different region for mode of effects. Accordingly, the analyze must adopt different methods. The dependability between incidence rate each month of CSF and meteorological factors from 1999 to 2004 was analyzed in this paper. The function of meteorological factors on CSF was explored and internal law was expected to be discovered. The correlation between the incidence rate of Swine Fever and meteorological factors, thus the foundation analysis of the early warning and the decision-making was made, the result indicated that the incidence rate of CSF has negative correlation with temperature, rainfall, cloudage; relative humidity has positive correlation with disease; for air pressure, except average air pressure of one month, other air pressure factors have positive correlation with disease; for wind speed, except Difference among moths of wind speed and average temperature of one month. have positive correlation with disease, other wind speed factors has negative correlation with disease.

Key words: e-government, knowledge management, frameworks, e-governance

1. DATA

1.1 Regions were studied

5 regions which incidence rate is relatively high were selected by epidemic situation. There was no different regularity among those regions for count of pigs and density of cultivation. The data is random distribution(see table 1).

Table 1 the cultivation situation of pig in 5 selected region

Region	Count of pigs (ten thousand)	Ranking in nation	Densityfor raising (head/km^2)	Ranking in nation
A	2817.00	fifth	119.01	eleventh
B	1081.33	eighteenth	23.82	twentieth
C	2544.76	seventh	64.59	Twenty-one
D	1853.43	twelfth	105.31	sixteenth
E	1937.14	eleventh	138.76	tenth

1.2 Epidemic situation data of CSF

The CSF epidemic situation data from 1999 to 2004 was collect from china statistics year book. The data include count of all alive pigs by the end of year. The incidence rate was calculated as count of morbidity for CSF/count of all pigs by end of year. The calculation formula as below:

$$\text{Incidence rate permonth}=\frac{\text{Total count of new cases in one month}}{\text{The total count of pigs in same month}}\times K$$

(*K:coefficient*, *unit:*1/ten thousands pigs)

1.3 Meteorology data

576 meteorology data be obtained for each province in 6 years(see table2).

Table 2 Synopsis of meteorology factors

Atmosphere factors	Simplified character	Atmosphere factors	Simplified character
Average air temperature per month	t	Average air pressure per month	a
Max air temperature per month	t_{max}	Min air temperature per month	t_{min}
Average relative humidity per month	h	Total cloudage per month	c
Average wind speed per month	w	Total rainfall per month	p

2. METHOD OF ANALYSIS

2.1 The treatment of meteorology factors

By treat further, more variables were created. Every factor was analyzed independently, and new variables were listed in table 3.

Table3 new variables of meteorological factors

variable	Index	variable	Index
Difference among moths of temperature	*d*	average temperature of one month.	*jp*
The same month meteorology value in correspondence with disease incidence rate	Footnote 0	The previous month meteorology value in correspondence with disease incidence rate	Footnote -1
The second month before outbreak's meteorology value in correspondence with disease incidence rate	Footnote -2	The meteorological factor mean value of the same month and the previous month	Footnote -01
The meteorological factor mean value of the same month and the two months before outbreak	Footnote -02	The meteorological factor mean value of the two months before outbreak	Footnote -12
Meteorological factor differential value of the same month and the previous month	Footnote 0-1		

Regarding the rainfall amount, subscript-01、subscript -02、subscript -12 are on behalf of total quantity, but is not the mean value.

Difference among moths of temperature was define as difference between max average temperature and min、average temperature of one month. was define as deviation from the mean between average temperature situation of one period and many years(Abeku TA, 2002), it was defined as difference between this month of this year and average value of 6 years. By this methods, 71 meteorology factors were produced and represent as x1-x71, those new factors were list in table 4.

Table 4 Contrasting form of variable forms of meteorological factors

Variable name	Actual value	Variable name	Actual value	Variable name	Actual value	Variable name	Actual value	Variable name	Actual value
x_1	a_0	x_{16}	c_{-01}	x_{31}	$t_{min\,jp}$	x_{46}	t_{-2}	x_{61}	w_{-12}
x_2	t_0	x_{17}	w_{-01}	x_{32}	h_{jp}	x_{47}	t_{max-2}	x_{62}	p_{-12}
x_3	t_{max0}	x_{18}	p_{-01}	x_{33}	c_{jp}	x_{48}	t_{min-2}	x_{63}	a_{0-1}
x_4	t_{min0}	x_{19}	a_{-02}	x_{34}	w_{jp}	x_{49}	d_{-2}	x_{64}	t_{0-1}
x_5	d_0	x_{20}	t_{-02}	x_{35}	p_{jp}	x_{50}	h_{-2}	x_{65}	t_{max0-1}
x_6	h_0	x_{21}	t_{max-02}	x_{36}	a_{-1}	x_{51}	c_{-2}	x_{66}	t_{min0-1}
x_7	c_0	x_{22}	t_{min-02}	x_{37}	t_{-1}	x_{52}	w_{-2}	x_{67}	d_{0-1}
x_8	w_0	x_{23}	d_{-02}	x_{38}	t_{max-1}	x_{53}	p_{-2}	x_{68}	h_{0-1}
x_9	p_0	x_{24}	h_{-02}	x_{39}	t_{min-1}	x_{54}	a_{-12}	x_{69}	c_{0-1}
x_{10}	a_{-01}	x_{25}	c_{-02}	x_{40}	d_{-1}	x_{55}	t_{-12}	x_{70}	w_{0-1}
x_{11}	t_{-01}	x_{26}	w_{-02}	x_{41}	h_{-1}	x_{56}	t_{max-12}	x_{71}	p_{0-1}
x_{12}	t_{max-01}	x_{27}	p_{-02}	x_{42}	c_{-1}	x_{57}	t_{min-12}		
x_{13}	t_{min-01}	x_{28}	a_{jp}	x_{43}	w_{-1}	x_{58}	d_{-12}		
x_{14}	d_{-01}	x_{29}	t_{jp}	x_{44}	p_{-1}	x_{59}	h_{-12}		
x_{15}	h_{-01}	x_{30}	$t_{max\,jp}$	x_{45}	a_{-2}	x_{60}	c_{-12}		

(1)footnote-1、-2、-12 represent that this factor will affect disease persistently.

(2)footnote-01、-02 represent the effect of average level of these meteorological factors on disease in recent period.

(3)footnote 0 represent those factors that affect the disease at present.(4)footnote 0-1、*jp* represent those factors that affect disease when changed.

2.2 Statistical analysis methods

The spearman's interclass correlation method was adopted in this study to analyze the relationship between meteorological factors and incidence rate of CSF each month, and hypothesis test of coefficient correlation was done either. The judge method of coefficient correlation r_s was: r_s range from -1 to 1, if $|r_s|>0.95$, there is significant correlation between meteorological factor and disease; if $|r_s|\geqslant 0.8$ indicate correlated highly; if $0.5\leqslant|r_s|<0.8$ indicate correlated moderately. If $0.3\leqslant|r_s|<0.5$, indicate lowly correlated. If $|r_s|<0.3$ indicate there was little correlation between factors and disease. If the r_s is positive, there is direct correlation between meteorological factor and disease, conversely negative correlated. r_s Supposition examination：H_0：$\rho_s=0$；H_1：$\rho_s\neq 0$；$\alpha=0.05$。

The SPSS13.0 statistical analysis software was used to process, and data file which contains the month disease incidence rate and various meteorological factor was established. The command procedure was: [Analyze]→[Correlate]→[Bivariate Correlations],and choose Spearman rank correlation coefficient analysis, and other options are default.

3. RESULT

3.1 Incidence rate of CSF in five regions

The computation of the month disease incidence rate extreme value computation sees the table 5.

Table 5 Extreme number of monthly incidence

incidence (1/10 thousand heads)	A	B	C	D	E
max value of Month incidence rate	1.383	1.726	2.017	1.985	4.143
min value of Month incidence rate	0.003	0.016	0.006	0.006	0.024
meanvalue of Month incidence rate	0.392	0.290	0.359	0.355	0.715

The tendency shows that incidence rate in autumn and winter higher than spring and summer. By incidence rate of every year, there emerge two peak rates in 2000 and 2002 respectively. However, the total tendency had been decreased in recent 3 years. See table 6, table 7 and Fig. 1, Fig.2.

Table 6 The calculation of monthly incidence

Incidence (1/10 thousand heads)	A	B	C	D	E
January	0.414	0.495	0.432	0.499	1.256
February	0.470	0.308	0.529	0.497	0.927
March	0.401	0.230	0.341	0.281	0.393
April	0.364	0.298	0.181	0.210	0.321
May	0.325	0.095	0.128	0.136	0.189
June	0.339	0.192	0.270	0.242	0.112
July	0.273	0.243	0.401	0.273	0.596
August	0.377	0.264	0.264	0.386	0.632
September	0.428	0.270	0.269	0.468	0.831
October	0.392	0.261	0.580	0.527	1.667
November	0.354	0.365	0.523	0.411	0.782
December	0.572	0.464	0.389	0.332	0.871

Table 7 The calculation of annual incidence

annual incidence (1/10 thousand heads)	A	B	C	D	E
1999	0.081	0.181	0.238	0.235	1.248
2000	0.328	0.376	0.469	0.217	0.736
2001	0.223	0.194	0.165	0.146	0.668
2002	0.767	0.732	0.853	1.019	1.228
2003	0.742	0.177	0.340	0.441	0.252
2004	0.213	0.083	0.088	0.074	0.157

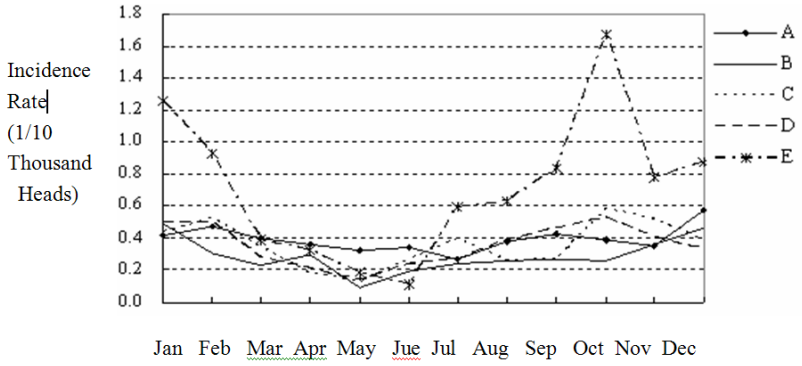

Fig.1 The scheme of monthly incidence

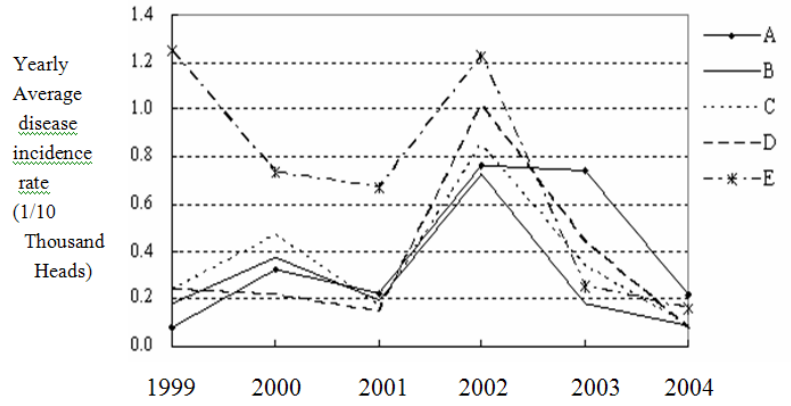

Fig.2 The incidence of CSF each month and the incidence each year from 1999 to 2004.

3.2 Analysis result calculated by Spearman's interclass correlation

The coefficient correlation r_s between 71 meteorological factors and incidence rate of CSF in these 5 regions calculated by Spearman's interclass correlation are show in table 8, 9, 10 and 11.

Table8 Analysis results about monthly incidence and meteorological factor in region B

Meteorological factor	r_s	Meteorological factor	r_s	Meteorological factor	r_s	Meteorological factor	r_s
x_1	0.357**	x_7	-0.361**	x_{12}	-0.252*	x_{36}	0.281*
x_2	-0.292*	x_9	-0.298*	x_{16}	-0.280*	x_{54}	0.251*
x_3	-0.291*	x_{10}	0.357**	x_{19}	0.312**		
x_4	-0.293**	x_{11}	-0.247*	x_{26}	-0.236*		

* *represented adopted 95% significance examination,*
** *represented adopted 99% significance examination.*

Table9 Analysis results about monthly incidence and meteorological factor in region C

Meteorological factor	r_s	Meteorological factor	r_s	Meteorological factor	r_s
x_2	-0.245*	x_{26}	-0.297*	x_{43}	-0.302*
x_3	-0.311**	x_{28}	-0.388**	x_{52}	-0.377**
x_{12}	-0.280*	x_{32}	0.268*	x_{61}	-0.357**
x_{21}	-0.247*	x_{38}	-0.251*	x_{70}	0.315**

* *represented adopted 95% significance examination,*
** *represented adopted 99% significance examination.*

Table10 Analysis results about monthly incidence and meteorological factor in region D

meteorological factor	r_s	meteorological factor	r_s
x_{15}	0.291*	x_{50}	0.300*
x_{24}	0.338**	x_{59}	0.313**
x_{41}	0.238*		

* *represented adopted 95% significance examination,*
** *represented adopted 99% significance examination.*

Table 11 Analysis results about monthly incidence and meteorological factor in region E

meteorological factor	r_s	meteorological factor	r_s	meteorological factor	r_s	meteorological factor	r_s
x_1	0.360**	x_9	-0.337**	x_{23}	-0.337**	x_{63}	0.359**
x_2	-0.290*	x_{10}	0.254*	x_{34}	0.327**	x_{64}	-0.412**
x_3	-0.309**	x_{14}	-0.330**	x_{40}	-0.256*	x_{65}	-0.369**
x_4	-0.287*	x_{18}	-0.250*	sx_{58}	-0.299*	x_{66}	-0.440**

* *represented adopted 95% significance examination,*
** *represented adopted 99% significance examination.*

A region: there was no associatively between average incidence rate each month and 71 meteorological factors. The result show that meteorological factors has little influence on epidemic of CSF in this Region (Artois M, 2002)

B region: there was associatively between incidence rate each month and 14 factors: (1) 5 of 31 temperature factors have associatively with disease, they are t_0、t_{max0}、t_{min0}、t_{-01}、t_{max-01}, all these factors are inverse correlation with disease. The effects of temperature on incidence rate each month mainly reflect in instantaneity and average level, and the continued effect is little. (2) 5 in 8 air pressure factors are direct relative with disease. They are a_0、a_{-01}、a_{-02}、a_{-1}、a_{-12}, the effect of air pressure on CSF is very great that instantaneity, average level and continued effects exist at the same time; (3)p_0 in rainfall has negative correlation with incidence rate, this result show that p0 affect the disease immediately.(4)the w_{-02} in wind speed factors has negative correlation with incidence rate, the continued function of wind speed affected incident rate. (5) 2 of 8 total cloudage factors affect incidence rate of CSF in an negative correlation ways, they are c_0 and c_{-01}.

C region: there are correlation between incidence rate of CSF and 12 meteorological factors.(1) t_0、t_{max0}、t_{max-01}、t_{max-02}、t_{max-1}, has negatively correlation with epidemic of CSF. Among these 5 factors, average max temperature affect incidence rate most significant. The survival rate of CSFV decreased in high temperature situation.(2)5 factors include w_{-02}、w_{-1}、w_{-2}、w_{-12}、w_{0-1} have correlation with incidence rate of CSF. Among of these factors, none but Difference among moths of wind speed have positive

correlation with disease. This result shows that the change of wind speed increased the incidence rate of CSF. (3) the incidence rate of CSF has negative correlation with a_{jp} and positive correlation with h_{jp}, and indicate that the change of these two factors affect the disease.

D region: only relative humidity factor has positive correlation with epidemic of CSF. These five factors are h_{-01}、h_{-02}、h_{-1}、h_{-2}、h_{-12}. this result show that the incidence rate of CSF would increased in moist environment. A continuous and hysteretic effect of these factors would make on disease.

E region: 16 factors have correlation with incidence rate of CSF. (1)10 factors include t_0、t_{max0}、t_{min0}、t_{0-1}、t_{max0-1}、t_{min0-1}、d_{-01}、d_{-02}、d_{-1}、d_{-12} in 31 temperature factors have negative correlation with disease. And the real-time and change of temperature affect incidence rate of CSF significantly. (2)3 factors including a_0、a_{-01}、a_{0-1} in 8 air pressure factors as positive correlation with incidence. The real-time and recent average air pressures affect disease greatly. (3)there are 2 in rainfall factors has negative correlation with disease. These correlations reflected as instantaneity and total level. (4)w_{jp} has positive correlation with disease. This result shows that change of wind speed in same time can affect incidence rate of CSF.

4. CONCLUSION

With result of correlation analysis, some conclusions can be arriving at: (1)incidence rate of CSF has negative correlation with temperature, rainfall, cloudage. (2)relative humidity has positive correlation with disease.(3)for air pressure, except average air pressure of one month, other air pressure factors have positive correlation with disease. (4) For wind speed, except Difference among moths of wind speed and average temperature of one month. Have positive correlation with disease, other wind speed factors has negative correlation with disease.

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