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The Dialectics of Nature in Phenology

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Abstract

Phenology, as a local knowledge mainly studied by observation, embodies the direct correlation between plants and animals in nature and the local environment. The dialectics of external and internal causes, contradiction and opposition, and negation and negation, which are embodied in phenology, reveals the inner logic and scientific method of phenology as a study, which is beneficial for a more scientific understanding and practice of phenology. The first part of the article firstly introduces the inevitable connection between phenology as a kind of local knowledge and agriculture, and the second part details the application of the three laws of Dialectics of nature in the study of phenology, thus showing how to use Dialectics in Phenology to better understand and influence nature.

Keywords

Dialectics of Nature, Phenology, Quantitative, Qualitative, Opposite, Negation and Negation

1. Introduction

Phenology is a science that studies the interrelationship between the cycles of plants (including crops), animals and environmental conditions (climate, water temperature, soil conditions) in nature. In ancient China, the knowledge of phenology was usually included in the calendar in the form of lunar orders, which were used to guide farming. In modern times, more systematic and regular observation and recording became the general approach of geophysics, which combined with biology and meteorology to enrich the understanding of nature and its application in agronomy. In the process of studying phenology, the role of dialectics of nature was gradually seen by scientists, and it can be said that phenology is the study of the manifestation of natural phenomena, while dialectic of nature is the doctrine of the inner laws of nature, and the combination of the

two provides a more scientific and comprehensive understanding of phenology of nature and agriculture.

2. China's Phenology

China has a tradition of geophysics in ancient times and has accumulated a wealth of phenological knowledge.

2.1. As a Local Knowledge

Before the 16th and 17th centuries, temperature and barometer were not yet available, and the concepts of "atmosphere" and "climate" did not yet exist. In ancient China, the summary of weather experience accumulated by the working people was attributed to the national legislation to guide agricultural affairs. In terms of time, five days were considered to be a Hou, three Hous were considered to be a solar term, and twenty-four solar terms were considered to be a year. In ancient times, China had a tradition of weathering, for example, the Counting Nine Song in northern China was based on the knowledge of the two equinoxes and two solstices. During the Han Dynasty, the year was subdivided into seventy-two periods. By the mid-nineteenth century, the knowledge of geophysics was incorporated into the "heavenly calendar" of the Taiping Heavenly Kingdom, and the observed geophysics and the sprouting of grasses in Nanjing really took care of local agricultural affairs, so geophysics is a local observation record.

2.2. The Interconnection between Phenology and Agriculture

In the natural world, many phenomena occur periodically in time. The change of seasons, the growth and decay of plants, and the migration of migratory birds are all phenological phenomena that repeat in time. The phenomena are regularly recurring from year to year, and all the phenomena appear in a certain sequence and are correlated with each other. By observing the weather, we can not only predict the time of sowing, but also the time of harvesting, and even predict the time of pests, that is to say, the natural calendar can predict the agricultural time. Engels pointed out that although animals are not as good at changing nature as humans, they can also change external nature through their labor. And the environment changed by animals, in turn, acts on them, causing them to undergo certain changes as well. "For in nature there is nothing that occurs in isolation. Things act on each other (Cao et al., 1955)."

A lot of work was done in China in the 1980s on the division of local seasons and natural calendars in several places, including Yuanping, Shanxi; Yibin, Sichuan; Guilin, Guangxi; Renshou, Sichuan; Luoyang, Henan; Yancheng, Jiangsu; Xi'an, Shaanxi; and Hangzhou, Zhejiang. Through the observation of local phenology, we find the suitable phenological indicators for farming. Yuanping County (currently a city), Shanxi Province Water Resources Bureau, according to the research on the high volume sowing period forecast in the physical calendar of

Yuanping City, Shanxi Province, to find the suitable physical indicators for sorghum sowing, that is, the local pear bloom peak to acacia bloom peak for the upper and lower dates of sorghum sowing period (Water Resources Bureau of Yuanping County Revolutionary Committee, 1974). The sorghum sowing time in 1978 was adjusted through a phenological approach, which increased the local timely underplanting area from 48.4% to 82%. Through more than six months of observation, the sorghum in that year generally grew strong, and the incidence was also reduced by 3% over the past year (Zhu & Wan, 1984).

Although the natural calendar is a local calendar, but there are certain links between regions. Beijing's natural calendar and Sichuan Yibin, Shaanxi Xi'an's natural calendar is close to the place. For example, they both use the peak flowering period of acacias as an indicator of the onset of summer. This shows that there are commonalities in the weather in a certain region. The advantage of using the natural calendar to predict the agricultural season is that, based on the appearance of natural weather phenomena, the appearance of related weather phenomena can be projected, because the weather phenomena are not only interrelated, but also have commonality. In addition, since the climate varies from year to year, if we only follow the season or date without referring to the immediate phenomena, there is a possibility that the farming time and farming machine will be misunderstood. Therefore, there is no substitute for the weather in agriculture (Engels, 1984).

3. The General Laws of Dialectics in Phenology

The laws of dialectics are the most general laws of both nature and the historical development of human society and of thinking itself, which can be simplified as follows: the law of transformation of quantity into quality and quality into quantity, the law of interpenetration of opposites, and the law of negation of negation. In Hegel, these three laws are treated as the laws of thinking only, while in Engels, the laws are not imposed on nature and history only as the laws of thinking; Engels believes that the world exists before human consciousness and the laws of natural dialectics are the real laws of development of nature.

3.1. Qualitative and Quantitative Changes in Phenology

In nature, the law of transformation of quantity into quality and quality into quantity is reflected in the fact that qualitative change, which for each individual occasion takes place in a strictly determined manner can occur only through an increase or decrease in the quantity of matter or motion (so-called energy) (Engels, 1984). The differences between substances in nature are either based on different chemical compositions, or on different amounts or forms of motion, or both. For a qualitative change to occur, a quantitative change must be produced through matter or motion. In phenology, quantitative and qualitative changes are reflected in the cycle of biological phenomena: in the annual repetition of the cycle, the importance of climate change for phenology is self-evident, but in ad-

dition, the internal mechanisms of nature are also important factors that influence this cycle.

According to materialistic dialectics, external causes are the conditions for change, internal causes are the basis for change, and external causes act through internal causes. In phenology, the external factors that drive phenology are: the length of day and night, and the temperature, while the internal factors are the internal mechanisms within organisms. While the effect of temperature on phenology is easy to observe, with the development of phenology, the length of day and night and the amount of rain also play an important role in phenology. The migration of migratory birds, as we know it, was usually thought to be due to climate change in the past, but an experimental study in Canada showed that the external conditions of migratory birds were determined by day length rather than temperature, and the determining factor was the growth of reproductive glands in migratory birds, caused by external factors acting through internal factors (Zhu & Wan, 1984). Another example is the 1920s research on plants has been the diurnal and diurnal plant division, diurnal plants such as oats, potatoes can only flower in the long day and short night period, and short day plants such as tobacco, cannabis can only flower in the short day and long night period, there are some plants such as apples, buckwheat can flower regardless of day and day (Wilsie, 1962).

3.2. The Law of the Interpenetration of Opposites

Opposites can be found everywhere in nature, the course of nature, is a constant struggle between opposites and the process of transformation. Dialectics holds that the resolution of the contradiction of opposites must be done by observing and analyzing the contradictory movement of things. In the way of studying nature, the research method of phenology follows this very path. Engels has pointed out the formation of the nucleus of a cell in organic life as the polarization of living proteins (Engels, 1984). Starting from a simple cell, it grows into a complex plant through the different effects of both genetics and adaptation. In the past studies, botanists considered the phenomenon of vernalization, photoperiodism and the action of plant hormones and enzymes as three influential factors in the flowering mechanism of plants. These three findings reflect the inherent contradictions in the plant growth process in different dimensions.

The phenomenon of vernalization in plants refers to the need for seeds to undergo a period of low temperature in the seedling stage before they can flower and bear fruit. In wheat cultivation, winter wheat must be planted in the fall in temperate or subtropical zones, and cannot spat and set flowers if planted in the spring, but spring wheat can. In China, farmers not only have some knowledge of the vernalization phenomenon through observation during planting, but also realize artificial vernalization by taking advantage of this phenomenon. For example, in case of natural disasters, when wheat cannot be sown in season, the "smothering jar method" is used to smother the wet seeds in a jar at low temper-

ature for 40 - 50 days, and then sow the seeds after the spring, and they can still grow and harvest.

3.3. Negation of Negation

Regarding negation, Engels believed that what is self-contradictory is not dissolved into zero, not into abstract nothing, but into the negation of its specific content (Engels, 1984). He also used the natural growth of plants to illustrate the form of the negation of negation. In his view, the fundamental cause of the development of things is not outside of them but inside them, in their internal contradictory nature (Zhu & Wan, 1984). The internal mechanism of plants is mysterious, because plants cannot move around as much as animals, and therefore they must maintain themselves in nature as much as possible by adjusting their own rhythm of growth survival. An old Chinese proverb says, "The willow looks to fall first in autumn", which is an illustration of the phenomenon of falling leaves in autumn. In general, broad-leaved trees stop growing leaves in late summer and early autumn so that the leaf ends become bud scales, thus protecting the growing points of branches and leaves from the cold winter. When the next spring warms up, the bud scales can grow back into branches and leaves.

The discovery of the photoperiodic phenomenon in 1920 also provided a new explanation for biological phenomena: plants and animals have a rhythm close to 24 hours (Circadian) with the change of day and night, and this rhythm is intrinsic and inherited from time to time. If plants and animals are placed in an environment where it is dark for hundreds of hours, this 24-hour rhythm will continue (Zhu & Wan, 1984). Thanks to this mechanism, the organism is able to measure time with relative accuracy, as Engels pointed out: the study of the embryonic development of plants and animals (embryology), the study of the remains of organisms preserved within the various strata of the earth's surface (paleontology). Thus, it was found that there is a special match between the gradual development of the embryo of an organism to a mature organism and the sequence of successive appearances of plants and animals in the history of the Earth (Engels, 1970), which shows that the natural causes exist within nature itself.

4. Conclusion

Phenology, as a local knowledge with observation as the main mode of study, is based on much more complex biology than scientific instruments. In terms of accuracy, it can indicate the arrival of the seasons more accurately; in terms of convenience, it guides agricultural activities in a more direct and simple way, that is easily accepted by farmers. This is where the importance of phenology for agriculture lies. The dialectic of nature in climatology reveals the inner logic and scientific method of climatology as a study, which is beneficial for a more scientific understanding of climatology and practice of climatological knowledge.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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