

PERCEPTION OF LIVING FORCES IN RICE CROPS

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1. Introduction

This paper approaches life processes in the rice crop South of Brazil agricultural year. Those processes are understood according to the science that was practiced in Ancient Greece. The paper approaches the transformation phenomena in the soil, plant, fauna and landscape. With this knowledge the farmers can make similares experiences in their landscapes.

In Ancient Greece, science was based on the perception and management of the four natural elements: Earth, Water, Air/Light and Fire. Bringing these concepts to the present, how in modern agriculture time can we find sense in them? May it be valuable? Could it contribute to soil management? In Ancient time, the agricultural calendar was read directly in the sky and the high priest, who knew astronomy, dictated the agricultural rhythms. In Astrology these concepts are connected to the Zodiac constellations.

It may appear far from the actual reality, but during the agricultural year the phenomena due to these elements can be observed and, from these observations, it is possible to make decisions. It is not a recipe, but one exercise to discover and learn from this observation. Through the year, each of these four elements can be observed in relation to the soil fertility, temperature, plant development, insects presence, birds, and so on. In this paper, these elements will be brought using as example the rice crop.

2. The rice cultivation in the Capão Alto das Criúvas farm, South of Brazil

In the Western, rice cultivation was not some typical activity. Culturally, rice was domesticated in the east and adapted to western culture. In Europe, the first records about rice growth happened in the South of Portugal between the V and VII century. In South of France the records point to introduction by Templars in Camargue region at the Rône river delta in the XIV century. The goal with that introduction of rice was to turn the saline soils in arable land. Until now, rice helps in crop rotation.

The environment where rice crops grow is of a very special peculiarity. It is ecosystems closely linked to water resources. Some areas are valleys where soils are made of solids coming from the mountains. We can say that rice crop soils are the most fertile soils in the world, with extremely vitality.

The quiet observation of these aquatic environments, leads us to a new way to study these environments full of vitality. In periods, seasons or depending on special weather conditions, we can contemplate the sunset and the eventide and see some dusk or some fog going to the valleys. We can say that the soil on the valleys receive both the depositions of

the flooding and of the atmosphere. Like a mother that shelters a child. The valleys have a coagulation motif while the mountains and hills have a gesture of expansion, like a man. It is in this exact “coagulation” environment or spot that the rice finds its habitat where another kind of cereal cannot grow.

Many adaptations in rice physiology and anatomy allow rice to grow in a flooded environment. Leaves can absorb nutrients in water solution in a gesture similar to a foliar fertilization. Rice also gets silicon support by the light and air relation. Because of this special relation with the silicon, rice gets success in generating grains in such conditions. Silicon brings light and structure to such a dark and wet environment.

Also, it is interesting to observe the differences between the soil and water layers in rice fields. It is common to believe in the exclusivity of air absence or anaerobic condition of the soil in the irrigated rice grows, but, in fact, there is a thin superficial aerobic layer on soil surface, under the water. The oxygen dissolved in the water supports that aerobic activity in the first layer soil. Like in the bottom of the seas and lakes, this small thin layer is extremely important and poorly researched in the rice fields. Superficial roots develop in that layer promoting a closed relation with soil biota. The quantity of the oxygen dissolved in the water depends on some factors: water temperature and water layer height. It is very important that research be done in these transitions: water surface X atmosphere, atmosphere X water surface; water layer X soil surface, soil surface X water layer. Between the surfaces is where the gaseous exchange and in these surfaces also can be observed the interaction with the nitrogen. The rice aerenchyma system does not transport only oxygen, but also nitrogen, because the atmospheric air contains 78% of nitrogen. The cyanophytes bacteria present in the rice stalk can promote nitrogen fixation. Each rice variety has a particular relationship and ability to make different gaseous exchanges.

We can ask ourselves which elements are needed in order to germinate a seed. We immediately recall warmth/light, air (O_2), water and soil itself, where plants are going to grow. Soils at the border of rivers are normally humid and they receive the benefits of floods. The water element is naturally present in these soils. When farmers cultivate the soil, they bring the air element to this environment. A vital impulse starts the germination process of the seeds of weeds already present in the soil. In a few days after turning the soil by plowing, the dark soil top becomes green, covered by new plants.

Modifying the equilibrium of the four elements -soil, water, air, warmth- the farmer floods the paddock for 21 days (a solar day), all the seeds that started the germination process start to develop foliar area and seeds that did not germinate will start dormancy because of lack of O_2 . Plants regarded as unwanted at the beginning (red rice, cockspur grass, zigzag jointvetch) will be biomass builders (green manure). In this flooding period of 21 days, several phenomena occur. Besides inducing seed dormancy, pH turns neutral because of saturation of bases.

With pH neutralization, nutrients are available for plants, making the ideal environment for the rice seedlings. That biomass is incorporated into the inundated soil producing available amino acids for the new rice plants. That decomposition digestion process of biomass needs guidance and it is here that the spiritual knowledge of biodynamic agriculture can contribute in a beneficial way. At this moment we do not want putrefaction but humus formation (OBS: in this stage it is used compost heap biodynamic preparations).

Keeping soil inundated along and after the biomass incorporation, other plants' sprout is controlled efficiently. Rice can be sown with seeds pre-germinated. In case of pre-germinated rice seeds, it is important to clarify that rice can develop radicle when water has

a concentration of O₂ above 4 ppm and develop epicotyl and leaves with levels of O₂ dissolved in water with values over 6 ppm. Because of this, pre-germinated rice follows its growing process on water.

After sowing, the application of biodynamic preparation 500 (horn manure) is done to favor the link of the plant to the soil, promoting initial rooting. Also, the management of the water level can change the plant architecture. With a deeper level of water, the plant will grow higher, with a shallower water level, the plant grows lower and with more roots. Handling water layers during the cycle of rice, by drying and flooding, favors live nitrogen formation and reduces the methane (CH₄) emission. During the crop cycle we can still promote living nitrogen according to the management of water.

Crop management works together with the vital rhythm and it can be perceived by the leaves coloration. At this initial foliar development, the application of biodynamic preparation 501 (horn silica) is done. In the first weeks, the young plants continue developing until a certain point that we notice a vigor loss and an apparent growing stagnation. Leaves lose the green intensity and when we examine roots, we notice that some pests are present in roots. In some points, the worm of *Oryzophagus oryzae* start to eat the new roots of rice, then, it is time to drain off the paddock, eliminating the water lay to inhibit the development of the insect.

This drainage demands wisdom and patience from the farmer to watch calmly the plant suffering. The process of vitality loss is intensified due to the lack of water, and it is important to be patient and trust that it is the right decision. At this phase it can be sprayed again the biodynamic preparation of horn and manure – prep. 500 - to stimulate root renovation. When water is back, a vitality explosion takes the rice crop, an intense green is disseminated and the plant reacts with intensity. This sudden exchange from flooding to dry and contrariwise, strengthening not only worm control but also significantly reduces the emission of methane in the cropping system and stimulates the formation of life nitrogen. The drainage stimulates change in soil life, anaerobic microorganisms die and immediately a new aerobic life is installed in the soil. With a new flooding in the paddock, another change occurs: aerobic microorganisms are substituted by anaerobic ones. Life and death shifts create a rich soup of microorganisms decomposition with high levels of nitrogen that collaborate with rice growth.

Plant growth comes to an end and starts a new stage where it prepares itself for flowering and in this stage, the water layer is elevated to protect the environment from temperature oscillations which are harmful for flowering. The elevation of the water layer also protects rice from the rice stink bug attack which needs a low water layer to suck the stem when panicles emerge. At the stage of grain growth, we can again promote drainage and floodings to favor the grain quality and the plant can receive again an application of preparation of horn silica –preparation 501 - which improves the grain taste and quality. Harvest is done preferably with dry soil.

3. Conclusions

In this text, the relationship between the four elements of Ancient Greek Science and the cycle of irrigated rice cultivation in southern Brazil was approached. The earth element can be directly observed in the seed before its germination, when it is static, immobile as a stone. When starting the germination process, we can already see a small

movement with the flow of liquids, presenting a movement like the process of the water element. The process of the air/light element is expressed at the time of flowering where the plant as a whole demonstrates itself in a gesture tending to free itself from earthly matter. And, finally, the process of the fire element is present at the moment of maturation and ripening when in this period the caloric processes act by drying the plant, crystallizing, drying the rice grain until taking it back to the solid state as the earth element.

By the way, we can observe the four elements happening in the soil itself. During the winter the ground is cold, and excessively wet, static like a stone. Here the earth and water elements are manifested. With drainage, the air element is invited to act, suppressing the water element. The entire soil biota reacts to changes. It is an invitation to vital processes to be activated. Human action (thinking and acting like the fire element) changes the balance of the elements bringing water. Water management provokes a sequence of action of all elements. When draining a plot the air element starts its action and little by little the fire element prints colors to the soil, inducing a saline process on the soil surface. Otherwise, when it is flooding again, a solubilizing process begins.

Human activity can be considered the performance of the fire element with its thinking capacity. The farmer's task is to contemplate the whole landscape, passing all the year by imaginative capacity, from which image is possible to decide the crop management and the farm organism. With those examples I want to show the possibility by which it is achievable to manage and lead a crop rice from the four elements of knowledge.