

## **CROP FORMATION RESEARCH IN UKRAINE USING SCIENTIFIC METHODS**

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## **ВИВЧЕННЯ НЕТРИВІАЛЬНИХ ФОРМАЦІЙ НА ЗЛАКОВИХ ПОЛЯХ В УКРАЇНІ ІЗ ВИКОРИСТАННЯМ НАУКОВИХ МЕТОДІВ**

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**Abstract:** The article describes the research results of the crop formation in a wheat field obtained by SRCAA «Zond» after the expedition in the village Kordyshivka in Vinnitsa region, Ukraine in June 2011. The bending of plants is the result of changing the direction of growth in nodes. It caused by the influence of an unknown phenomenon at the cellular level. Also, the soil chemical composition in formation is different than in control samples.

**Анотація:** У статті наведені результати досліджень нетривіальних формацій на пшеничному полі, проведених УНДЦА «Зонд» під час експедиції у с. Кордишівка Вінницької області, Україна, у червні 2011 р. Встановлено що полягання пагонів відбулося внаслідок зміни напрямку росту рослин, викликаной впливом невідомої природи на клітинному рівні, а ґрунт зазнав змін хімічного складу.

**Introduction.** Anomalous phenomena are a mostly non-periodical, transient and unclearly localized in the environment. So there is a little possibility for researchers to study them and develop working hypothesis. But the crop formations that appear in the plants fields since old times give a chance for investigation. This phenomenon shows some regularity and residual material evidences. Anomalous effects in a crop formations exhibit same stable parameters in different places and at different times. Recent research on the fundamental characteristics of crop formations are devoted to the modeling of effects that cause plants changing, to the comparative analysis of their growth etc. [3, 6, 9, 12].

Ukraine is an agricultural country, and its territory contains many wheat fields. But up to this moment the crop formations have been reported too late or the reports have been not qualified and the quantity of evidences has not exceed 1-2 per year, so we have no scientific studies about this. It seems that the main reasons for this are following: mostly flat areas (it is well-known that hills and mountains make detection of crop formation simplest) and a minor development of agricultural and private aviation. Also most of people are not informed about the phenomena and not motivated to report about it. The media in villages are still isolated so there is very low ability for researchers to monitor the appearance of local messages about the phenomena.

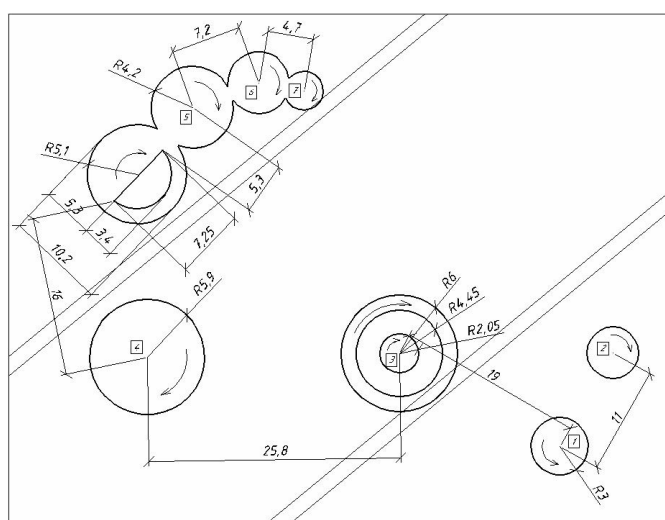
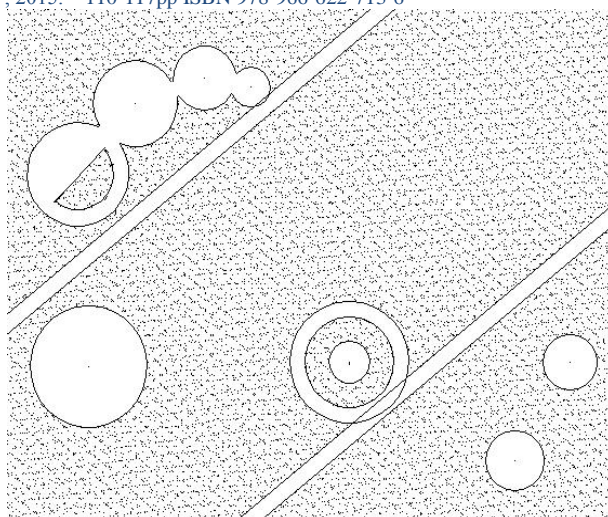
Formations investigated SRCAA in Ukraine during the period since 2004 and until now, are associated with changes of plants colour and direction of growth. It was the result of uneven reset of fertilizers or modifications due to natural factors [1]. Fragmentary messages concerning the crop formations appearance where the stems of plants were being bent, repeatedly coming for Ukrainian researchers. But typically it was too late after the harvesting was over.

Thus, when in June 2011 we received information about the appearance of the crop formation near the village Kordyshivka (Fig. 1), it was the first opportunity to explore the phenomenon in Ukraine using scientific approach and with minimum delay in time.

**Methods.** Formations were registered by the local employees of the agricultural sector during the irrigation of the field in a night time on 18 June 2011. Actually only the sufficient height of sprinkler-machine helped to visually identify formations that were placed on the plain and it is impossible to see them at a distance more than 40 to 60 meters. It is difficult to recognize the clear date and time of the formation appearance. There was no regular monitoring of this territory. The formation is located at a distance of about 300 m from the nearest settlement building and about 100 meters from the village road. The working group included four SRCAA experts: A. Bilyk, O. Kyrychenko, M. Myronov and S. Verhovynin who investigated the anomaly in a 25 of June after receiving of initial information from the local newspaper on the 22 of June. The crop formation is consist of the eight circles with a diameter of 4 to 12 m (Fig. 2, 3) located between the tracks for agricultural machinery. In the case of seven circles the plants were bent clockwise and in one - in opposite direction. The change of the plant growth's direction was between  $30^0$  and  $60^0$  and made in one or two nodes at a height above the ground about 40 cm. In a circle with the notched segment (Fig. 2) plants were bent clockwise and along the edge of a segment.



**Fig. 1.** Kordyshivka village on a map of Ukraine, and a place of crop formation appearance



**Fig. 2.** The crop formation scheme after the geometrical measuring (meters)



**Fig. 3.** The central circle and the part of crop formation





**Fig. 4.** The hole in a soil in a centre of one of the circles (bended plants around the hole are damaged by humans)

It is significant that in the middle of seven circles was found a hole in the soil with a diameter of 2...2.5 cm with straight edges from which the soil has been apparently removed (Fig. 4). The initial holes depths were up to 25 cm according to the witness evidences. The depth measured by SRCAA was about 15-17 cm. It should be noted that the plants and the holes at the time of the study were damaged due to uncontrolled visits of inhabitants and rainfall in June.

According to verbal evidences from witnesses who have visited formations within the first day after the spotting of crop formation, have experienced psycho-physiological problems, malfunctioning mobile phones and discharged batteries. During the expedition such manifestations were not observed, may be it because of a week delay between the crop formation appearance and investigation date. No anomalous aerospace phenomena have been recorded in the investigated area during the last time, but we cannot exclude that it did not occur.

Measuring of electric field intensity of low (30 ... 300 Hz) and ultra-high frequency (50 MHz to 3.5 GHz) showed not significant deviations above zero. The level of gamma radiation on the formation was 12..14 microrentgen per hour, which corresponds to the background parameters measured in the village Kordyshivka and near the field where the anomalies were found.

Observation of the local bio-detectors (swallows, ants) also did not reveal abnormal behaviour when it crossing formation borders. However it should be noted that after a week of rain residual effects could have neutralized. The search for metallic objects, particles using metal detector also have shown no results. For the aerial photography it has been used the radio-controlled helicopter model with the attached camera. But unfortunately due to short-circuit which occurred during a very rainy weather, the device was burned, so the aerial photography was not performed. The experimental and control samples of plants and soil were taken during the expedition. The test samples were collected directly from the formations in a locations that had not been damaged by rain and people, and with reflected a change in the direction of growth in nodes (Fig 5,6).

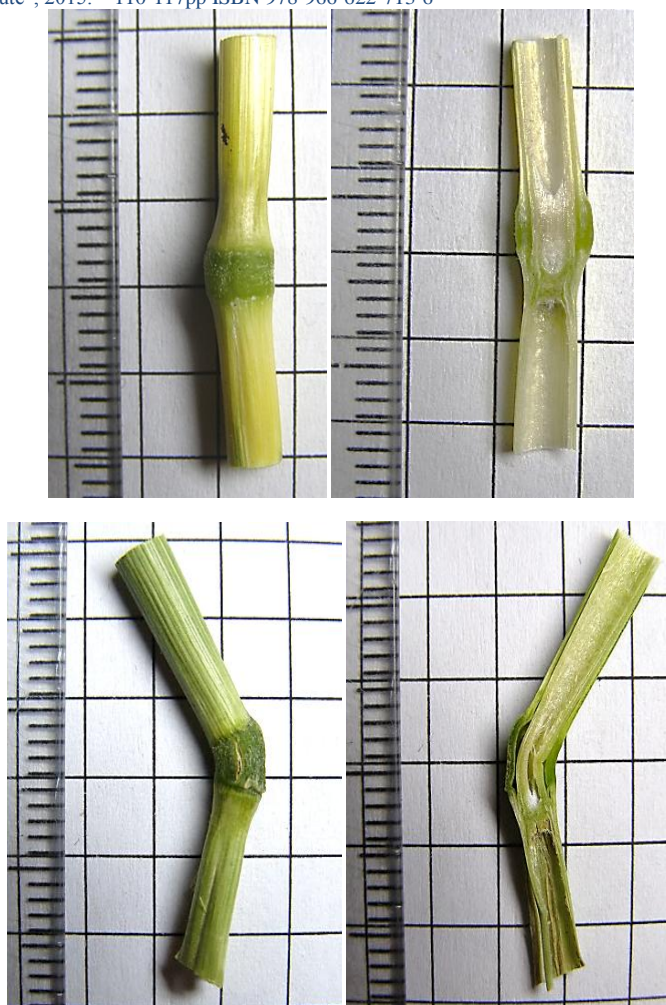
Control wheat plants samples were taken from the same field at a distance of at least 100 meters from the crop formation. All samples had no any direct contact with human or materials, and the conservations were carried using hermetic plastic bags. The sufficient storage and transportation procedures were done.

The samples of loam soil were taken from a depth of 5cm in different places. Analysis of samples was carried out at the National Scientific Centre «Institute of Agriculture, National Academy of Agricultural Sciences of Ukraine» in the «Department of Agroecology and analytical research» using methods according to ISO 10390:1994 and IDT Soil quality.

Research results (Table 1) shown convergence in samples chemical composition for the presence of biogenic elements. The same effects have been observed (and in the normal range) with the usage of fertilizers on wheat plants, which could not lead to any bending itself. At the same time were obtained the anomalous differences between firmly fixed forms of heavy metals - zinc, manganese and iron. Natural factors that could cause such differences within the same soil with similar sampling method, according to conclusion of the NSC «Institute of Agriculture NAAS» - remain unknown.



**Fig. 5.** The plants samples taken from formation with the growth direction change



**Fig. 6.** The catted nodes taken from control wheat plants and from the crop formation

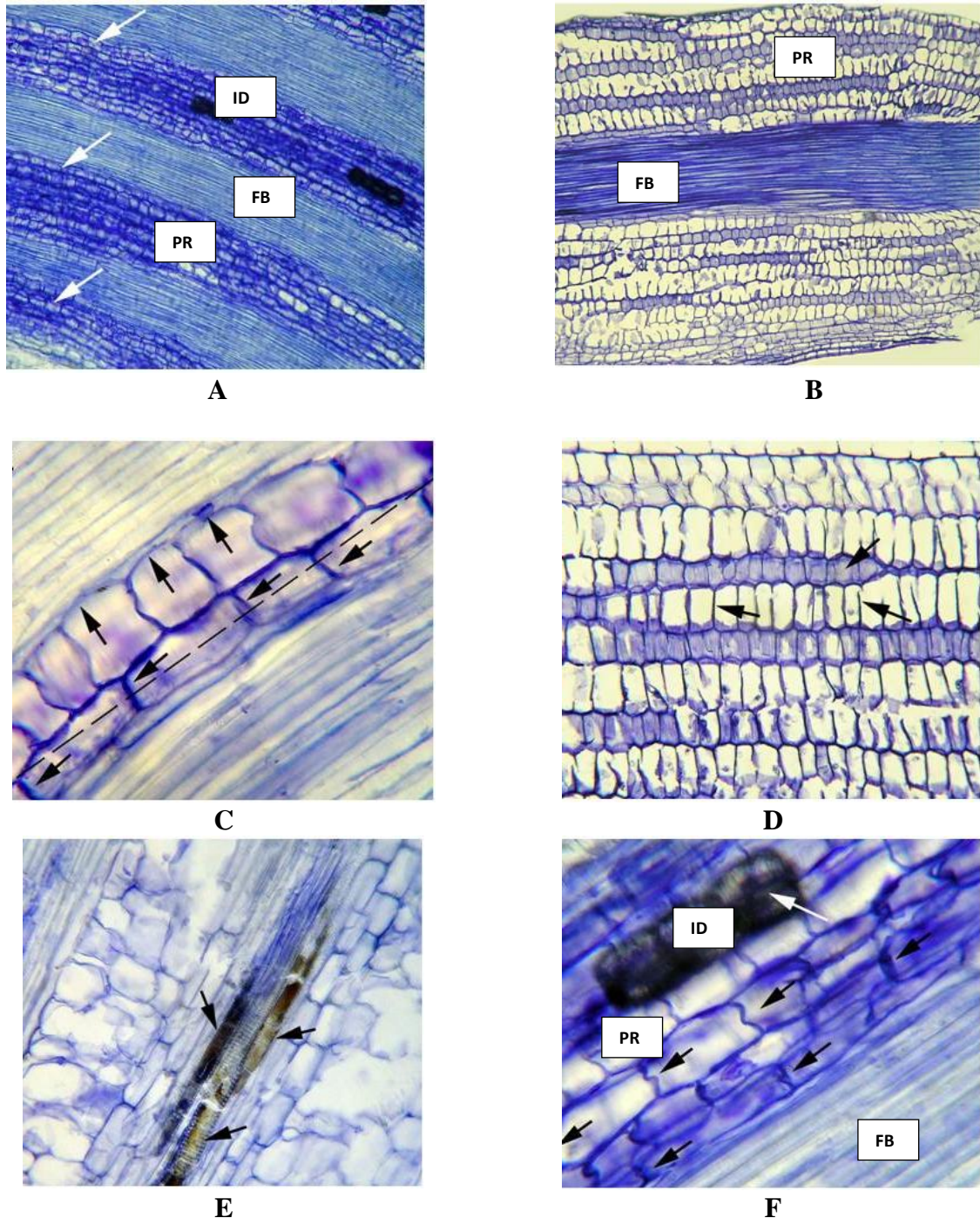
**Table 1.** The results of chemical composition analysis of soil samples

Sample	The exchange acidity pH	Organic substances, recalculated on humus %	Common forms of biogenic elements, %				Firmly fixed forms of heavy metals and microelements, mg per kg of soil						
			N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Na <sub>2</sub> O	Cu	Zn	Pb	Cd	Ni	Mn	Fe
1c	4,7	1,40	0,06	0,02	0,68	0,10	10,0	36,7	78,3	12,5	90,8	158,3	9830,8
1f	4,9	1,56	0,05	0,01	0,65	0,09	10,0	20,8	78,3	14,2	97,5	258,3	5535,0

1c – integral control samples, 1f – integral formation samples

Anthropogenic factors such as deliberate contamination of surface are excluded due to the depth of sampling and integral nature of the selection of the control sample. An anthropogenic factor such as intentional soil surface pollution also seems doubtful due to the depth of sampling and integral nature of the selection of the control sample. This allows suggesting some hypothesis about the association between the anomalous soil chemical composition change and the strange bending of plants. However the mechanism responsible of this association remains unidentified.





**Fig. 7.** Photomicrographs of organic tissue structure of wheat samples leaf collar zone: A, C, E, F – plants taken in crop formation; B, D - control samples; PR - parenchyma; FB - fibers; ID - idioblasts of some polyphenolic compounds that are not soluble in xylene, chloroform, ethyl alcohol and water; Graph A – arrows marks the bundles of fibers and parenchyma strands that due to asymmetrical arch stem growth to return the optimal spatial position; Graph B, G - parenchyma and sclerenchyma control intact plants, slightly curved arrows marked periklinal parenchyma walls; Graph C, F – arrows shows the direction of growth and stretching of parenchyma cells; Graph D – arrows shows the blockage of plants vessels by some resinous phenolic substances

Wheat has a type named «Master», the plants were twice treated against pests and regularly were sprinkled with water. Samples stems were provided for analysis to the National University of Life and Environmental Sciences (NULES), in to the Department of Ecobiotechnology and Biodiversity (Expert PhD, AssProf A. F. Likhanov). Visual inspection of plants showed anomalous change of wheat in the nodes, which cannot be the result of a known viruses or pathological plants abnormalities. In addition, it known that the wheat type «Master» is one of the most resistant types to extreme conditions.

As a result of morphological and anatomical studies of samples of wheat, it was found that the plants shown the typical signs of straightening the stems after damage that is a characteristic feature for wheat. But the reason of the bending of samples according to the research by NULES Department of Ecobiotechnology and Biodiversity could not be determined clearly. Mainly this is explained because of the long time (one week) between the phenomenon acted to the wheat and the sampling performed. Also the test plants were under high anthropic loads (damage by humans), which could have led to additional changing in organic matter. The main conclusions from the NULES scientific report are presented below.

Anatomical analysis of the test plants showed that the parenchyma cells amount was unilaterally increased in the area of wheat leaf collar zone comparing to control plants. This may be the result of the hormonal stimulation meristematic tissues.

A characteristic feature for wheat plants is the presence of sclerenchyma strands, which in a leaf collar zone alternating with the layers of parenchyma and gradually transformed into lamellar collenchyma. In collenchyma cells the intrusive growth was marked (growth among neighboring cells) and an insignificant thickening of cell membranes. Because of asymmetric division and tension of collenchyma and parenchyma cells, a stem bends toward the zone that opposite to zone of maximum growth.

In the injured plants in the nodal parenchyma in the individual chlorenchyma cells and in the tracheids were accumulated some phenolic substances. The number of idioblasts (the cells with chemical composition which is very different from the others) was increased. The increased synthesis of secondary metabolites, including polyphenolic nature may be response of plants to the influence of some external negative factors with biogenic or abiogenic nature. In a control samples leaf collar zone had a typical structure for a wheat plants, parenchyma cells almost isodiametrical, or had a slightly elongated periclinal walls. Idioblasts in a control samples were not found.

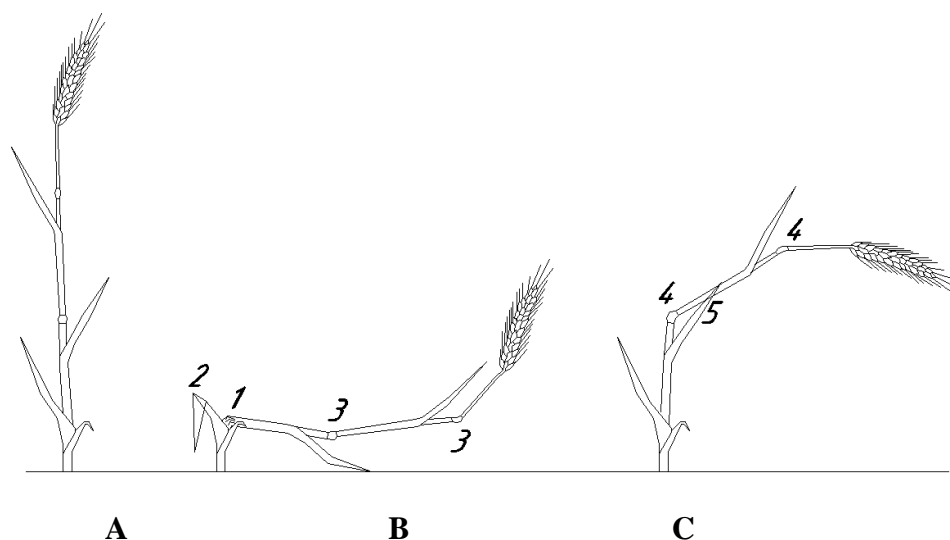
In conclusion, NULES Department of Ecobiotechnology and Biodiversity research suggested that hormonal stimulation of meristematic organic tissues may have occurred as a result of special electromagnetic field modulation.

**Results.** The investigated crop circles formations have a complex nature, accurate dimensions and geometry. This and the registered changes of soil chemical composition and plants tissue allow to reject the natural hypotheses such as wind, animal behaviour, insects, growth abnormalities, plants diseases and others. Therefore the main hypothesis left on the origin of the formation of the crop circles is the artificial one. The artificial origin hypothesis due to the actions of agricultural machinery or standard wheat processing, is excluded because of the complex and irregular crop formation structures that are located asymmetrically in comparison with the tracks for machinery. A nontrivial version about artificial random formations occurrence due to radiation, accidents on chemical factories also seems unrealistic because of the relative remoteness of crop formation from the known sources of radiation and chemical stimuli. So then, the most appropriate anthropogenic hypothesis is the artificial deliberate creation. It is well known that some crop circle formations appearing around the world are artificially created by mechanical damage of plants by humans. However, crop formation researchers [12] noted couple of basic factors of abnormality that helps to distinguish an unknown phenomenon from the human-made mystifications:



- 1) The absence of mechanical damage of plant
- 2) Changes in a plant biochemistry
- 3) Possible modification of the soil chemical and quality composition
- 4) Possible residual effects of temporary electromagnetic field.

The investigation of crop formations near Kordyshivka shows the first three of these four basic factors of abnormality and also the verbal evidences related to the fourth factor was received. Analysing the hypothesis about the human-made mystification we should also take into account that the formation place is located some 15 kilometres away from the closest highways and cities. The nearest houses of the Kordyshivka village located at a distance of hundred meters from the formation. The place is not located on hills, and therefore the probability of crop circle's detection from the human perspective poses a real problem. Meanwhile the main purpose of mystification is to attract media attention and self-promotion, so the human-made hypothesis seems very doubtful, especially if taken into account the high difficulty and labour input needed to create the crop circle's formation in a short time. Not-obvious semantic content of crop formation geometric shape is not major but additional argument for this.



**Fig. 8.** Comparison of wheat stem change due to mechanical damage and due to unknown anomalous influence: A- without change, B - change after mechanical damage, C - change in a crop formation, 1 - place of mechanical damage, 2 - accompanying damage of leaves, 3 – tropism effect, 4 – bend in the node due to unknown anomalous influence, 5 - leaves particularly unchanged

The SRCAA «Zond» and NULES research of the plants bending indicate that in a case of plant mechanical damage the internode zone was broken and the leaves were damaged. Near the roots, the crown zones were also damaged. Over time the plant growth direction had bent up towards the sun's direction due to the phototropism phenomenon (see below). Also, over a time, the damage of stem or near root, crown zone area in artificial formations can lead to plant wilting, starting from the periphery of the leaves. In a case of a huge mechanical damage, proper transportation of nutrients in stem not happens and the plant dies.

As the part of the analysis of different hypotheses, the question about the possible mechanism of the plants growth direction changes was also considered. In particular in the study the following question was asked: in the case of an artificial origin of the crop circles' formation, could another mechanism have been used, except the mechanical damage? Apparently the only one other mechanism that could be used – is the behaviour of the plant itself. It is known that plants like any living organism work as a system with feedback and significant variety of

reactions to changes in the environment, shape, line height, colours, etc., depending on the species. This ability is well known as a tropism. In particular, as noted above, plants after some mechanical damage can show the positive tropism to the sun light direction. Can the direction of plants growth change be achieved by artificially directed tropism? It seems that the directed tropism for single plants can be achieved in artificial conditions using one of the following ways:

- Irradiation plant using electromagnetic field with the directed modulation (electrotropism)
- Arrangement of artificial one side lighting conditions for a plant (phototropism)
- An artificial creation directional mechanical stress in a plant tissues, which leads to compensatory cell layers growth (kind of a gravitropism).

Defined options require additional studies. However, even in a case of their relative effectiveness, their application in a short time, in a full scale and in a conspiratorial field conditions are very doubtful. So then, the hypothesis of human-made mystification of crop formation at this stage of research can be rejected. Overall, the phenomenon remains anomalous.

**Discussion.** The independent expert conclusions obtained during this research is correlated with world crop formation studies experience [3, 6, 9, 12]. Currently the prevailing hypothesis of the plants changing is the one related to the electromagnetic influence. However, the parameters of the radiation that would allow selective and directed influence on each node and led to the registered structural and biochemical simultaneously changes in many plants, remain unknown, as well as a tropism mechanism itself [2, 11]. Also any electromagnetic influence cannot explain the change in the soil chemical composition in a crop formation area. It is possible that the electromagnetic component may be only a secondary parameter. It may be the evidence of a deeper interaction on information level [4], of a quantum mechanical effects of the mechanisms of plant growth [7, 14] etc. We hope that future studies will give more robust theoretical basis of the phenomenon mechanisms and improve the methodology of the crop formation study.

In addition, the cause of the phenomenon existence remains unknown and the semantics of formation figures. Unfortunately, despite the significant accumulated amount of evidences and studies, the level of our understanding of formations content is still low. Currently, we can only classify the structure of picture of Kordyshivka formation as a so-called «planetary-like», because of the «secondary» circles situation around the central one [8, 10]. But of course, all of our hypotheses are only an interpretation in terms of human logic. It is important to remember, that any anthropocentric point of view to such phenomena is wrong and not useful for real scientific investigation. Opinions that the crop formation pictures could be explained by a possible response to our messages to the cosmos and other similarly «communication» hypotheses is more evidence of our interpretations of the phenomenon and its interaction with us rather than an evidence of a real dialogue. Also we should remember that crop formations require thorough examination for the exclusion of possible hoaxes. Theoretically our expectation of manifestations in our plant fields from hypothetical extra-terrestrials is not more realistic than ourselves expecting chalk marks on our front doors.

Phenomenon is reflexive and it works as a feedback system [5, 13]. However, the feedback on our input signals of this system is not necessarily. And obviously it is not the main purpose of the phenomenon. We should remember that mankind has begun to notice crop formations in a period, when there were no possibilities of observation and measurement to understand the level of image in a full scale. The main fact that we know – that the plants are changed due to the impact of unknown origin. And such unexplained phenomena require some very comprehensive study. It is not only a question of scientific research and the informing the community but also a question of public safety. Because the modified wheat grains in crop formations have been harvested, milled and the bread has got in to some kitchen desk.

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