Research Report from Pinelandia Biophysical Laboratory

Crop Formation: Phoenix, Arizona 2005 Laboratory No. KS-06-107 July 12, 2005
Location: Three Fields on Buckeye Rd., Phoenix, Arizona
Material: Barley, (Hordeum vulgare), upper node plus seed heads, with soil samples taken at sampling sites.
Discovered: Early May, 2005 and sampled May 27, 2005
Sampled by: Ms. Kathy Doore, Surprise, AZ.

Formation Characteristics: Large downed areas forming long narrow strips with irregular edges, and containing random patches of upright plants. All downed lanes were located with their long axis in a N -S direction.

Laboratory Findings:

As data were analyzed it became apparent that Kathy Doore incorporated an important factor in the sampling protocol, which heretofore has been only minimally considered. As she collected samples of downed plants, she looked for the nearest clump of standing plants and sampled them in a similar manner. In the laboratory analyses three groups of plant samples were analyzed; namely the "downed plants" taken in the formation, "standing plants" taken in the formation and "controls" taken well outside the formation areas.

Apical node lengths were determined (using the normal procedure) in all of the plants submitted (Total - 218). When these node length data were examined in relationship to the three specific sampling sites, it was evident that the level of applied energy was very similar over the entire sampling region. For this reason, the data were combined, and the results of the statistical analyses are listed in Table 1.

Table I.

Node length CNd measurements in Crop Formation KS-06-1 07

Sampling Site	Ave.NL (mm)	sd	N-plants	V-variance
Downed Plants-in formation	4.88*	0.58	50	11.9%
Standing Plants- in formation	3.24*	0.46	83	14.2%
Controls- outside formation	2.62	0.26	85	9.9%

*--P<0.05

It is interesting to note in Table 1, that both the downed and standing plants have statistically significant node-length increases compared with the controls. The level in the standing plants lies provocatively between the downed and controls. This suggests that the applied energies were quite different in intensity at the standing plants, compared with plants at the downed areas

In addition to the significant node length increases, there were other interesting changes in the apical nodes. In Fig.1 are nodes representative of the major sampling regions. In the upper set of nodes from normal or control plants, there are two factors which are characteristically observed in normal, mature plants of barley (and other species in this family); namely, the shrinkage or drawing inward of the node into an "hour glass" shape, and the brown coloration.

The center photo in Fig.1, of nodes from standing plants within the formation, both the lateral shrinkage and coloration are reduced in frequency, in fact, we observe here the beginning stage of node swelling. In the bottom photo showing nodes from downed plants within the formation, this node swelling becomes quite obvious. Here, the microwave energies in the plasma vortex strike the plant and cause the nodes, with their higher moisture content, to swell, soften and bend over. At the same time, this heating also breaks down the normal pigments in the node tissue, therefore the brown coloration was not formed at maturity.

The two photos shown in Fig.2, point out the very interesting possibility that the field was subjected to the vortex energies at two different stages in the plant development cycle. Both abnormal growth effects were discovered in samples from Field-2, sample set #3 plants. The left photo shows an apical node with what has been defined in this laboratory as an "expulsion cavity". Previous studies of crop formation samples containing these cavities, have provided clear evidence that this anomaly forms near complete maturity of the plant. When a plasma vortex system interacts with the plants, the microwave energies heat the interior of the stem nodes (the nodes have a higher dielectric constant than the internodes), thus producing sufficient pressure to cause the node to expand (see Fig.1 bottom photo), providing the tissue is still green and viscoelastic. If the plants are mature the outer cellulose fibers are beginning to dry out and, as is the case here, the node literally blows apart.

By contrast, the interesting morphological changes shown in the right photo in Fig.2, occurred at the initial stages of seedling development. The upper arrow points to the apical node, out of which grew the twisted, severely deformed peduncle (stem between apical node and the seed head). Normally, the peduncle extends vertically above the node, with lengths in the range 10-20 cm. The stem region between the apical and penultimate nodes (between the arrows) is also of much shorter length than observed on control plants. The attached seed head is of normal appearance and contained well developed seeds.

This type of stem deformity, although rare, has been detected in several other crop formations in wheat. What is demonstrated in Fig.2-right, is that the energies in crop formations can selectively injure specific tissue regions on the plant. So far, these studies indicate that tissue regions undergoing rapid or active cell division (mitosis) are altered, whereas, nearby tissue may be unaffected. The important point here is that the plasma energies appear to have interacted with the field at two different times during the development cycle of these plants.

A question that one might now ask - are there other alterations in the plants, which were induced by these external energies? The answer to this was provided by data obtained in a standard, paper roll germination test, using seeds from the three sampling sites. In this protocol the seedling growth data at the 5-day stage of growth, allows one to apply a development factor (Df), given by, $Df = fg \times Sh$.

Where fg is the fraction germinated in the roll and Sh is the average seedling height. Three sample sets (of 30 seeds each) were examined from each of the Phoenix sites and the data are summarized in Table II.

Table II.

Seedling development factor calculated from germinations tests (Df determined at 5-day development in a controlled germination chamber).

Sampling Site	ave.	sd	N-seeds
Downed Plants- in formation	1.47*	0.40	90
Standing Plants- in formation	1.94	0.48	90
Controls- outside formation	3.16	0.39	90

*-P<0.05

From these data it is quite apparent that the applied energies have significantly reduced the development vigor in the seeds from the formation. If we compare the data in Tables I & II, we find that there is an apparent inverse correlation between the mean values of node lengths and seedling development. In other words, as the mean node lengths significantly increased, the seed vigor (Df) consistently decreased. This is exactly what would be expected if the formation energies are influencing the seedling growth related tissues in the plants.

These growth differences are also illustrated in the test rolls (Fig.3) from the bioassay germination series. The upper photo shows seedling development in one of the 30-seed, paper test rolls containing seeds from the normal or controls plants outside the formation. The seeds from the standing plants inside the formation (center photo Fig.3) produced only slightly fewer seedlings (fg in equation-I), but the lengths of the seedlings (Sh in equation-I) were greatly reduced. Seeds from the downed plants (lower photo in Fig.3) inside the formation produced both fewer and reduced seedling height.

With plant alterations at these levels of significance it was not surprising to lind, as shown in Table III, high levels of magnetic-drag material. The mean levels are given for each of the major sampling sites. The normal or control level outside most crop formation areas is around 0.4 mg/g-soil, or less.

Table III.

Magnetic-drag material collected within three fields, at the Phoenix, AZ, crop formations (KS-06-107)

	Mg/g-soil		
Sampling Site	ave.	sd	N-locations
Downed Plants- in formation	26.4	10.7	8
Standing Plants- in formation	40.0	11.4*	8
Controls- outside formation	23.6	14.9	7

P<0.05

It might seem counterintuitive that the highest deposits of H-drag material was found in the standing plants, rather than in the downed plants, which as shown in Table I and in Table II, experienced the highest intensity of energy input. A strong clue as to what happened here was presented in a side note on Ms. Doore's sampling diagram; *"all standing and downed crop samples were taken together within* 5 *to 10ft. of each other* ". In the downed regions the radial velocities of the plasma vortex systems, are at a maximum. From the mathematics of forces inside a rapidly rotating vortex system, it has been shown that the centripetal or outward directed force on particle in the vortex, increases with distance from the center of the vortex. Since there is no "barrier" around these energy vortices, a fraction of the particles are spewed outward and end up at the base of the nearby standing plants, and beyond.

The high distribution of particles in the control samples in Table III, also supports this concept of particle densities being controlled by centripetal forces inside a vortex system. These outward directed distribution patterns are not unique with the Phoenix formation, but are in complete accord with many other crop formations studied at the Pinelandia Laboratory.

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Fig.l Stem node characteristics in plants from Phoenix crop formation KS-O6-l07; Photos top: Controls (outside formation);
Middle: Standing (inside formation); Bottom: Downed (inside formation)

Fig.2 Morphological abnormalities indicating that Plasma Vortex Energies interacted with field of barley, at two different growth stages
(crop formation KS06-107, Phoenix, Arizona)

Fig. 2 a (left photo): Expulsion cavity formed at apical node in a fully mature plant.

Fig. 2b (right photo): Deformed peduncle; Field-2, Sample-3, downed.

Fig.3 Vigor differences in barley seeds from crop formation KS-O6-107 (seeds grown in temperature controlled germination chamber) Top Photo: Controls----(outside formation); Middle Photo: Standing----(inside formation); Bottom Photo : Downed----(inside formation)

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