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THE POTENTIAL FOR WEATHER MODIFICATION IN NEBRASKA

N. J. Rosenberg and Grant I. Johnson^{1/}

Interest in man-controlled weather modification, including hail suppression, is high in Nebraska.

While little scientific research into the subject has been done in Nebraska, considerable work has been done by others around the nation and world and there is extensive literature available on the subject.

This circular pulls together some of the information available on weather modification and relates it to Nebraska conditions. It treats the subject in three parts: increasing rainfall, hail suppression, and legal aspects.

Where an abstract is specified, it means this is the author's interpretation of data which has not yet passed the test of questioning by his peers.

INCREASING RAINFALL

Cloud seeding under some circumstances is known to increase rainfall modestly (10 to 20 percent). However, the American Meteorological Society (AMS), in a recent position paper (1) states:

"...results (in seeding the eastern United States non-orographic storms) are not as clear-cut as in the case of orographic storms." Orographic storms are those in which initiation of rainfall is caused by the lifting effects of mountains. They are typical of the western slopes of the mountains of Oregon and Washington, but not of the Great Plains.

They state further: "The evidence on hand indicates that cloud seeding can neither produce nor terminate droughts. Such conditions are associated with persistent patterns of air motion which inhibit formation of clouds or precipitation. Clouds must be present for the occurrence of natural or man-made precipitation."

Research in the Plains Region has been done in western South Dakota and North Dakota under the auspices of the Institute of Atmospheric Sciences of the South Dakota School of Mines.

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Other research has been done in southern Missouri by the University of Chicago in cooperation with the Department of Atmospheric Science of the University of Missouri at Columbia.

Reports from South Dakota (2) indicate that they have achieved modest increases in precipitation by aerial seeding of selected clouds with silver iodide.

However, reports of "Project Whitetop" in Missouri (3) suggest a 30 to 52 percent decrease in rainfall on days when clouds were seeded by aircraft. All statistical tests applied to rain gauge and radar echo measurements suggest a net negative effect from seeding.

However, Prof. Wayne Decker of the University of Missouri, in a personal communication with the senior author, suggested that the seeding may have increased precipitation in an area 50 to 100 miles downwind.

Economic Justification

Huff and Chagnon of the Illinois State Water Commission have done an economic evaluation of potential cloud seeding benefits to corn yields in their state (4). They begin with clear statistical evidence that both rainfall and temperature are involved in yields of unirrigated corn.

A 10 to 20 percent increase in rainfall, which may be possible, would not produce any sizeable increases in yield during the years when rainfall is low and temperatures high.

It would take increases in rainfall of more than 100 percent to produce significant increases during such years.

The maximum theoretical advantage for cloud seeding would occur during years when rainfall is only slightly below average and which temperatures are much above normal. These optimum conditions which would make additional rainfall "pay off" were found to occur very seldom in Illinois.

HAIL SUPPRESSION

The Committee on Atmospheric Sciences of the National Academy of Sciences in 1966 reported on an analysis of results of field experiments in weather modification (5).

One of their comments was, "There is a wide range of opinion on whether or not hail can be effectively suppressed or its damage mitigated. The U. S. experiments using ground generators or aircraft generators have been inconclusive."

The position paper of the AMS (1) states, "The possibility of suppressing hail and lightning remains in doubt, but there are indications here and abroad that some degree of success may be possible and research therefore should be actively continued."

Russian experiments using anti-aircraft guns and rockets to shoot ice-nuclei of various kinds into supercooled parts of developing hailstorms have recently been reported. The methods are supposed to be in use over large areas.

Recent American observers of the methods (6) while not absolutely certain of the results, consider the techniques important enough for independent testing in this country.

South Dakota scientists report on a long-term series of hail experiences with cloud seeding with silver iodide (7). Results in terms of shortened duration of hailstorms, reduced energy of impact of hailstones and other factors suggest that when proper techniques are used some mitigation of hail damage is possible.

We see the appearance of interest in hail-suppression techniques. New research programs are being developed and proposed. Perhaps, before the '70s are over we will have definitive answers on whether hail suppression can be practiced effectively and with predictable results. The subject still is one for which the research answers are needed.

LEGAL ASPECTS

A good many legal minds have been involved in the problems of weather modification. There have been many cases involving claims (probable or otherwise) of damage due to weather modification efforts.

Persons doing weather modification work in Nebraska must be licensed by the State Weather Control Commission for each site or project.

Nebraska law now defines weather modification to include "...initiating, changing or controlling the cause or effects of forces, measures and other factors constituting weather phenomena, including temperature, wind direction and velocity."

It has been recommended that the definition in the model law proposed by the Weather Modification Association be adopted in place of the present one. The model law definition of weather modification reads, "Changes in the composition, behavior, or dynamics of the atmosphere which are artificial and intentionally induced."

The model law suggests that no two operators be licensed to operate in the same geographic area or in areas which overlap.

CONCLUSION

Research evidence concerning rainfall augmentation and hail suppression neither fully supports nor discourages efforts at weather modification. Far more intensive research will be needed before we can speak with any certainty of the likely outcome of any weather modification effort.

It is recommended that when any such efforts are made commercially, careful records be kept so that results can be assessed scientifically. Further, those interested in modification efforts should acquaint themselves fully with existing law on the subject.

Continued organized scientific research sponsored by reputable scientific agencies should be encouraged so that the feasibility of weather modification can be definitely proved or disproved.

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CONCLUSION