

***Ricerca svolta nell'ambito del progetto finalizzato CLIMAGRI  
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**THE CLIMAGRI RESEARCH PROJECT CARRIED OUT BY ITALIAN MINISTRY OF AGRICULTURE  
ABOUT CLIMATIC CHANGES AND AGRICULTURE: A REANALYSIS OF STATISTICAL  
SIGNIFICANCE OF DATA COLLECTED IN THE RAIN ENHANCEMENT PROJECT DEVELOPED IN  
SOUTHERN ITALY**

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## Abstract

It is briefly presented an Italian searching project on the relations between climatic variations and agriculture. One of the topic is a reanalysis of statistical significance of data collected in the rain enhancement project developed in Southern Italy. It is also presented the actual Italian situation about the rain enhancement.

## 1. Introduction

Climagri is an organic research system in the field of climatic variations and their impact on the agriculture. It is financed by the Italian Ministry of Agricultural and Forestal Politics (Ministry of Agriculture) and it has a programmed duration of three years. Its second year of activity began in September 2002. Central Office of Agrarian Ecology (Ufficio Centrale di Ecologia Agraria (UCEA)) holds the general coordination of the project. Climagri is articulated in the following four subproject:

- Climatic analysis and future sceneries in Italy
- Italian agriculture and climatic changes
- Drought, desertification and water resources management in the South of Italy
- Information and data spreading

## 2. Structure of Climagri

In the first subproject it is attempted to acquire an objective answer on the consistence of climatic variations in Italy and on future meteo-climatic sceneries.

In the second one it is attempted to estimate what climatic changes mean for important fields of

Italian agriculture, in order to plan eventual contrast actions.

The third one is carried out to get a deeper knowledge of some themes linked to water resource. It is important to underline the international interest on this last theme and to its importance for Italy and a lot of other countries. For this reason UN have defined the present year, 2003, as the "water year".

The last subproject is about the improvement of weather forecasts for agriculture, and of data and project results spreading.

In the first year operational activities regarded:

- A collection of data as complete as possible
- Layout of data recording systems
- Concepts specification
- Calculation systems and models setting

The project also provides a data spreading system on Internet at the following site [www.climagri.it](http://www.climagri.it) and in a multilingual version, provided by FAO, at [www.fao.org/sd/2002/EN501\\_en.htm](http://www.fao.org/sd/2002/EN501_en.htm), through a co-operative agreement with FAO, which also regards a co-operation with the Mediterranean countries to give them the availability of results, and methodologies of interest.

Climagri is however an Italian governative project, opened to national and international collaborations.

## 3. Important topics of Climagri

Some of Climagri themes are in the following list:

- Analysis of Italian historical series for a study of climatic variations
- Study of a possible variation of meteorological structures and of Italian pluviometric regimes
- Construction of high resolution climatic sceneries for the study of their effect on Italian agriculture
- Effects of climate modifications on frost risks and on satisfaction of specific amount of chilling units for the cultivated species
- Active role of agriculture in mitigation processes of the global climatic changes
- Seasonal experimental forecasts at Italian level

#### 4. The Rain Project (Progetto Pioggia)

The Rain project (Progetto Pioggia) has been an Italian randomized rain enhancement plan, developed from 1985 with a preparatory phase in response to the drought experienced in Southern Italy (Vento et al; 1994).

It was co-financed by the Italian Ministry of Agriculture from 1988. The initiative was taken with the purpose of applying Israeli methods and technology of rain enhancement in Puglia and other regions of Southern Italy. The experiment was based on a feasibility study of Professor A. Gagin. In Puglia the seeding operation were carried out by EMS, a subsidiary of Mekrot, the National Water Company of Israel.

The rain project was a cross-over design with two alternative target areas, a buffer in between, and two additional control areas. Seeding was by injection of silver iodide into clouds by aircraft flying near the bases of clouds along predetermined tracks upwind of the target area.

The experimental units were rainy days. Interventions were based on information acquired through meteorological soundings, meteorological analysis and radar images. Tecnagro, an Italian association, detained the operative organization. A scientific Committee, chaired by Prof. List (B.A. Silverman, R. Gabriel, Z. Levin, T. Karakostas, G. Maracchi, A. Nania), was in charge in order to ensure the scientific development of the project.

To control results, UCEA with own resources for the installation and for the maintenance, has installed from 1991, quite

operative from 1992, that is after the beginning of the experiment, a specific network of 80 automated recording raingages in order to provide information concerning rain collected in the experimental areas (targets and controls) during rain stimulation operational campaigns. Raingages were separated by no more than 10 km one from the other and could furnish rain information every ten minutes during the seeding period and every hour out of the seeding period.

UCEA relied on an International Committee, of which G. Morgan, G. D'Aubigny and prof. Damiani, this latter from the Statistics Department of Rome University "La Sapienza", were part.

The rain project was interrupted in 1994 for lack of funds, even though it had to last for five effective years.

#### 5. Evaluations of the "Progetto Pioggia"

UCEA concluded that data obtained through the experiment were not enough to lead to a statistically significant judgement. The same opinion was expressed by the International Committee of Tecnagro and reaffirmed on the international press (List R. et al., 1999): "*The analysis of the experimental results along the lines recommended in the initial design shows no discernible seeding effect during the Puglia rain enhancement experiment*".

UCEA completely expressed its results for the first time at the Seminary of the World Meteorological Organization, at the Third University of Rome, Italy on 22.5.1996, about "Weather Modification-intervention technologies and results evaluation.

These results were part of the intervention "The control of the experiments of weather artificial modification". Results were also reaffirmed in Bari, Italy, in 1996, November 12-15, at the Conference on "Theoretical and Practical Aspects of a Regional Precipitation Enhancement Program for the Middle East and the Mediterranean" in the intervention of D. Vento: "The rain enhancement experiment in Southern Italy: control activity of the Italian Agricultural Administration" and in the press (Vento D., 1998).

#### 6. Evaluations on rain enhancement

An international debate, with different positions, coming from several reliable searchers and institutions, has been carried out about the

efficacy of the seeding (*Rangno A.L. et al, 1995; Dennis A.S., 1996; Orville H.D., 2000; Woodley W.L., 2002*). Anyhow it is important to hold in due consideration the opinion expressed on June 2001 by the Executive Committee of WMO, in the WMO/TD No. 1059, page. 141: *"Despite the statistical evidence of radar estimated precipitation changes in individual cloud systems in both glaciogenic and hygroscopic techniques, there is no evidence that such seeding can increase rainfall over significant areas economically. There is no evidence of any extra-area effects"*.

On this matter TecnaGro has taken a strong position in favour of the efficacy of the method (Bartolelli M., 2001).

In this situation during the setting of the Climagri project, UCEA decided to carry out a re-examination of data collected during the Rain Project and of eventual other ones available afterwards. From 2001 UCEA has asked for the reflectivity radar values, which belongs to TecnaGro. It is not still possible to examine them.

In Climagri UCEA has taken other statistical directions relying again on the Statistical Department of the University of Rome.

## 7. Reanalysis of the "Progetto Pioggia"

In order to validate results of Italian experiment, the research line moves towards the building of a model joining radar observations in the experiment area and ground observations of rainfall and other meteorological variables. This may allow a better comprehension of what happened when the seeding took place and evaluating the efficacy of the latter (Jona Lasinio G. et al., 2003).

Therefore at present there are no news which can differ from what UCEA affirmed at the end of the operative activities. Elaborations will be probed and a definitive opinion, on the ground of the available information, will be possible only at the end of the third activity year of the Climagri project.

Meanwhile in Italy the Cabinet of the 19.7.2002 has decided for a 9 million of € financing to carry out by a decree of the Civil Protection, expecting seeding as already operative. There are yet no news of the emission of such decree.

In this connection on Italian press there have been favorable (Zichichi: "It is possible to carry rain where it is needed" (Gambillara M., 2002)) and contrary positions (G. Maracchi of the Scientific Committee of TecnaGro: "The scientific experience and most of all Israeli experiments have lead to contrasting conclusions. Even at the best, also the experimenters supported the episodic and limited character of the effects. A lot of Italian searchers and meteorologists believe that the immaturity of results is a hindrance to the elsewhere technologies transfer; impulses and resources should firstly invest a strict evaluation of the effects rather than the operative plans (Menichella M., 2002).

## 8. Final consideration

According to UCEA the eventual whole operative activity of rain enhancement, whether indispensable, should plan also at least an organizational aspect which must totally assure proper catch basins to contain the rain for a following correct distribution and utilization, otherwise a real enhancement would be lost.

However UCEA, through the examination of collected and analyzed data about rain enhancement, affirms that for rain enhancement in Italy at present there are not ready solutions or univocal evaluations about the efficacy. The searching phase in order to arrive to a solution has still to go on. The physical and statistical efficacy appraisal must refer to a proportionate number of cases. It is scientifically and commonly known that considerations cannot found on single cases or on narrow groups of cases. WMO asserts that every statistical efficacy evaluation must reflect a physical explanation of the results; besides an efficacy full certainty must precede the extension from limited experimental areas to extended ones.

## 9. References

- Castagni E.: "Dopo i soldi, la pioggia artificiale" ("After money, rain enhancement") - *Il Messaggero* (newspaper), 13, 20.7.2002.
- Bartolelli M.: "Le modificazioni artificiali della fase atmosferica del ciclo naturale dell'acqua" ("Artificial modifications of the atmospheric phase of water natural cycle"), TecnaGro, 2001.

- Dennis A.S.: "Changing perceptions of the Israeli water modification program". - *J. of Weather Mod.*, vol. 28, 83-85, 1996.
- Gambillara M.: "Contro la sete del Centrosud 500 milioni" ("Against the Middle-sud thirst 500 millions)- *Avvenire* (newspaper), 5, 17.7.2002.
- Jona-Lasinio G., Orasi A.: "Modeling and exploring multivariate space-time variation: a geostatistical approach" - *Statistical Monitoring for Environmental Engineering: Models and Applications to the Province of Bergamo*, in press 2003.
- List R., Gabriel K.R., Silverman B.A., Levin Z., Karacostas: "The rain enhancement experiment in Puglia, Italy: statistical evaluation" - *J. of Appl. Met.*, vol.38, 281-289, 1999.
- Menichella M.: "Guerra sulla pioggia artificiale" ("War on rain enhancement") - *Il Sole 24-ORE* (newspaper), 5, 17.7.2002.
- Orville H.D.: General comments - *WMO/TD* No. 936, vol III, 78, 2000.
- Rangno A.L., Hobbs P.V.: "A new look at Israeli cloud system experiment" - *J. of Appl. Met.*, vol.5, 1169-1193, 1995.
- Vento D., Esposito S., Serra M.C.: "On the control of a rain enhancement experiment in Southern Italy" - *WMO/TD*, n. 596,35-37, 1994.
- Vento D.: "Incremento artificiale della pioggia" ("Rain enhancement") - *L'Informatore Agrario* (magazine), n.18, 35-38, 1998.
- Woodley W.L., Rosenfeld D.: Comments on "A critical assessment of the seeding of convective clouds for rainfall enhancement" - *Bull. of Am. Met. Soc.*, 739-740, 2002.