EFFECT OF GIBBERELLIN ON DORMANCY OF SUNFLOWER SEEDS

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Abstract

Dormancy of the just harvested sunflower(*Helianthus aanuus* L.) seeds was successfully overcome with the treatment of gibberellin . With the seeds immersed in 100 ppm gibberellin solution for 5 hours , the germinating viability (GV) was 21% and the germinating percentage (GP) reached to 83%. The GP tended to decreasing with the increase of the gibberellin concetration and immersing period .

Key-words: Gibberellin, Sunflower , Dormancy

Introduction

Dormancy of the sunflower (*Helianthus annuus* L.) seeds is one of its biological characters. After maturing, the sunflower seeds have a dormant period of 35-40 days . The existence of the seed dormancy brings the difficulties to the studies and utilizations for the crop. Many materials and methods have been used by the breeders for overcoming the dormancy of the seeds . The objective of the study was to examine the effect of gibberellin on the dormancy of the sunflower seeds.

Materials and methods

The genetically stable sunflower lines 555 , 533 and 524 , which were good in maturity and of dry hull, were used in the trials with 1500 seeds for each.

The seeds were immersed in the different gibberellin solutions of 0 ppm(control),10 ppm, 50 ppm, 100 ppm and 200 ppm for 1 hour , 5 hour and 10 hour , respectively. After immersing , the seeds were washed with the tap water and then placed in the plant growth chamber at 24-25C for germination. The GV was checked in 72 hours and GP in 168 hours. Each treatment was replicated for 2 times and the means of the two replicates was used for variance analysis.

Results and discussion

The results showed that the differences were significant between the lines, between the gibberellin concentrations, between the interactions of immersing period x gibberellin concentration and between the interactions of line x immersing period x gibberellin concentration (Table 1). The test of the difference significance of the immersing periods, gibberellin concentrations and germinating percentages showed that in the treatments of the gibberellin concentrations, 100 ppm gave the highest germinating percentage among the treatments of the immersing periods so that the 100 ppm was the best gibberellin concentration for overcoming the dormancy of sunflower seeds.

Table 1. Variance analyses for the effects of the sunflower lines, gibberellin concentrations and immersing periods on dormancy of the sunflower seeds*

VR	DF	SS	MS	F	F0.05
Blocks	1	40	40	0.817	3.96
Treatments	44	11408	372.9	7.62	
SL	2	11910	595.5	121.28	3.11
IP	2	178	8.9	1.28	3.11
GC	4	565	141.3	2.89	2.48
SlxIP	4	292	73	1.49	2.48
SlxGC	8	143	17.9	0.37	
IpxGC	8	1923	40.4	4.92	2.05
SlxIPxGC	16	1397	87.3	1.78	1.77
Error	44	2152	48.9		
TV	89	18600			

* VR=variation resource, SL=sunflower lines, IP=immersing periods, GC=gibberellin concentrations and TV=total variations.

The results of Duncan's multiple range test for the immersing periods and average germinating percentages showed that 5 hour immersing treatment was significantly different from 1 hour immersing treatment($p=0.01$)(Table 3).

In line with the results in the trials, the sunflower seeds which were just harvested could be effectively overcome by the treatment of gibberellin solution. The concentration of 100 ppm and immersing period of 5 hours were the optimum which gave 21% germinating viability which was 42 times higher than the control and 83% germinating

Table 2. Test of the difference significance of the immersing periods , gibberellin concentrations and germinating percentage

Immersing periods (h)	Gibberellin concentrations (ppm)	Germinating percentage (%)	Significance 5%	1%
1	100	82.0	a	A
	200	70.0	b	B
	0	64.0	bc	BC
	10	58.6	c	C
	50	53.3	c	C
5	100	90.7	a	A
	200	38.7	a	A
	50	75.3	b	B
	10	64.7	c	C
	0	56.7	d	D
10	100	87.4	a	A
	200	83.3	a	A
	50	70.6	b	B
	10	67.4	bc	BC
	0	60.0	c	C

Table 3. Duncan's multiple range test for the immersing periods and average germinating percentages

Immersing Periods (h)	Average germinating percentage (%)	Difference significance 5%	1%
5	75.22	a	A
10	73.74	a	A
1	65.58	b	B

percentage which was 27.6 times higher than the control. The germinating percentage tended to decreasing with the increase of the gibberellin concentration and immersing period. When the technique is used, the time after maturity should be considered. Within 30 days after maturing, the seeds can by treated with the method .

Sunflower Processing
Advances in Quality Assurance

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Abstract:

Sunflower cultivation in Argentina has grown considerably over the last 20 years, giving rise to a notable increase in related industrial production. The present technical paper looks at the pertinent philosophy to be applied in this expanding area and presents advances in the design of the quality assurance process and in the required equipment.

Actual installations are used to illustrate aspects of manpower, management, safety and pollution. Recommended action for new and existing plants is put forward, and an analysis is made of modern, automated controls, their economic justification, the quality objectives they seek to achieve and the areas to be monitored. A comparative analysis is carried out of solvent loss, of some specific imputs, and of the quality attained in meals and oils. Data are based on the experience of a company which crushes over 1,600,000 sunflower tons per year.

Key words: **sunflower processing-quality control-automatic controls**

Introduction

The present work deals with quality assurance in sunflower crushing plants and gives an overview of the concrete events that have characterized the almost continuous transformation of the Argentine sunflower processing industry over the last twenty years, generating a surfeit of oils and meals and giving rise to wider opportunities for export.

The processing of sunflower commenced using equipment designed for other oilseed types, which affected the quality of production, resulting in low protein meal and a lack of homogeneity in production. The technologies utilized were a product of circumstantial adaptation to new opportunities and were far more labour intensive than nowadays. No record was kept of the rate of consumption of the equipment with respect to the amount of tons produced.

The introduction of systematic controls permitted optimization at the same time as generating research studies and publications which were to lead to the development of better equipment and hence improvements in the production process. Looked upon originally as just one more additional cost, Industrial Safety was formerly associated neither with quality nor with the concept of quality assurance. Emphasis was placed on quantity rather than quality, and little thought was given to the considerable generation of polluting effluents arising from the practically uncontrolled emission of powders and liquids. A look back over the years in Graph 1 clearly shows that the changes introduced have been positive.

The Philosophy of Quality Assurance

A number of predominantly economic criteria have been applied over the course of the transformation process in order to generate adequate processes for attaining the desired Quality and to strive towards the achievement of increasingly homogeneous products.

Technology
- Reliability, avoiding unnecessary stoppages.
- Reduction in the need for mechanical maintenance.
- Increase in the length of continuous work periods.
- Automation of the processing operations.
- Reduction in the number of machines used.
- Continuous and automatic sampling.

Labour
- Highly qualified supervision.
- Permanent training at all operational levels.

Safety
- The adoption of international norms, principally as applied to the control of solvent extraction.
- Professionalization regarding Industrial Safety and Hygiene.
- The preparation of manuals on safety and operational procedures specific to each plant.

Pollution
- Set as a goal the total elimination of polluting processes.
- Reduce consumption of water, vapour and air in aspiration and drying processes
- Eliminate liquid effluents and reduce gaseous effluents in solvent extraction.

In recommending spefic actions it is necessary to draw a distinction between existing plants and new plants.

To illustrate my point I shall draw on the experience accumulated by the MORENO Group, an enterprise that has grown alongside the development of sunflower in Argentina and which today crushes 1,500,000 tons of sunflower seed a year. The plants currently operating date from different periods and have undergone a series of adaptations over the course of the last thirty-five years. The procedures I am about to describe were actually implemented in these plants.

The first step is to draw up and implement an optimization programme, for which purpose the preparation of a flow chart for each process is called for, eliminating unnecessary circuits and separating overflow bins in order to flexibilize operations. Once the main problems have been solved the next step is to incorporate automatic control and machine-feeding systems.

- Initially the most adequate system is one of distributed control.
- Once the most suitable circuit and analysis routines have been established, then one can go on to deal with any problems that arise and draw up an adjustment plan. At this stage it is convenient to install automatic samplers.

In designing **New Plants** the following aspects are to be taken into account:

- Comply with the norms and regulations in force for food production plants.
- Have in place a centralized, real time operational control process.
- The control system should be distributed, with independent analogue and digital controls.
- Man/machinery interface via interconnected computer screens.
- Flow chart should include overflow bins and feeder controls.
- Independence from traditional manual sampling operations.
- Avoidance of effluents, eliminating the liquids generated during extraction and reducing gaseous effluents.
- Make provision for the incorporation of biological filters to eliminate odours.

Processing Control: The economic justification for processing controls has long been the subject of discussion. Basically one has to pose the questions: How stable is production,? What type of control systems are already in place? How exigent is the market? What are the most frequent types of perturbations? Are future modifications under consideration? The enterprise may then aim to:

- Achieve a daily production rate that is within 5% above or below the monthly average at least 70% of the time. (The graphs compare the production figures for a typical month eight years ago and now)
- The first step is to correct the fault, probably due to some mechanical or design problem.
- If a PLC is available it has to be decided whether to expand this or incorporate distributed control systems, keeping in mind the need to remain competitive. In the former case it may be justifiable to make a large investment right from the outset with a view to reducing long-term costs.

In short, after detailed analysis of all relevant aspects the decision has to be taken with the top management about which philosophy to follow. Caution should be exercised in the implementation until sufficient experience has been acquired.
Finally, justifying automation from the economic point of view is difficult unless we associate it with the final quality of the product and customer satisfaction. The overriding criterion in the decision to install automation should be the technical justification. We should strive to improve our knowledge in the field in order to put forward our own, tailor-made proposals instead of just accepting the suggestions of the firms selling the equipment. The ultimate objective is to achieve the desired quality.
I shall now list some of the stages in the process and the parameters to be controlled.

Reception:

- Incoming seed is sampled in the truck using mechanical equipment.
- Sample division is carried out automatically in the receiver of the sampling chamber.
- The sample is weighed on automatic scales and foreign matter is determined mechanically.The sample is analysed electronically to determine humidity and fat content.

Conditioning:

- The homogeneity of the seeds is controlled at unloading.
- The seeds are categorized according to their level of humidity and foreign matter content and then deposited in separate silos.
- Humidity is controlled by automatically regulating drying velocity and air temperature.

During the first stage in sunflower processing the seed, held at a constant silo humidity, is pre-cleaned and dried, the hull content is determined, and the same parameters are controlled as in any equivalent traditional process. The following chart **(Process Balance)** shows the control scheme, or mass balance based on:

- The weighing of the seed, the hull, kernel and pellets and the measurement of oil-flow.
- The feeding mechanism including the dryer should be connected up with overflow bins permitting the regulation of the load and thus avoiding obstructions and overloading.

Preparation: A key element in the preparation and extraction process is adequate management of the thermal conditions affecting oils and meals, particularly prior to crushing. The temperature at which processing is carried out, its duration and the humidity or direct vapour used are crucial since high temperatures or excessively long periods can partially destroy protein content.

Extensive literature exists on the subject of protein solubility and on the deterioration of aminoacids in general. On the basis of such data modern desolventizers regulate the level of meal at each stage of the process, control the temperature, regulate direct vapour and indicate the flow of vapour used and the temperature of the effluent gases. Such controls enable rapid adjustments of the work program in accordance with changes in the production program. In our experience it is possible to assure that an automatically controlled desolventizer can be run at 25% of its capacity without detecting variations in the quality of the proteins.

Solvent Extraction: In solvent extraction both solids and liquids must be controlled. Two areas are thus involved: desolventizing the meal and the oil. The elements involved in the desolventizing of meal are:

- Direct and indirect consumption of vapour
- The height and temperature of the meal at each level
- The temperature of the effluent gases in desolventization

  Using field sensors and an adequate control process it is possible to manage the parameters that regulate the desolventizer, thus giving us access to higher operational security.

In the distillery it is necessary to control the following:

- The temperature of the miscella and oil output at each stage
- Automatic regulation of the heating vapour of each piece of machinery
- Indication of the operating pressure of each evaporator
- Indication of the temperature and flow of water in the condenser
- Control of the flow of miscella and final oil output
- Automatic regulation of the water dosification and of the chemicals used in the degumming process.

In the next graph, **Destillery Control** we see how the controls to achieve the desired temperature are put into effect when perturbations in the feeding of the miscella occur. A series of alarms indicate the relevant action to be taken.

As can be seen in the graph **Solvent Loss**, a drop in the consumption of solvent occurred between 1985 and 1995, as detected through the analysis of each controllable effluent in the solvent extraction process.

Expander: The installation of this piece of machinery has led to improved performance in plants working at a very exacting pace. Without going into details, I can say that adapting the expander to sunflower processing yielded the same benefits accruing to the prior stages.

Communications and Logistics: The appearance of computers on the scene and their integration into the production process together with the control processes installed, the use of modern telephone facilities with modem and communications by microwave or satellite have all served to connect up the data pertaining to plants geographically distant from one another. This has permitted comparative and statistical studies on production to be carried out at the commencement of the harvest season. The buyer thus knows in advance what he is receiving and is assured that quality levels will be maintained, which in turn puts him in a better position to be able to appreciate what makes up the final cost.

As regards wax content, 2000 PPM was earlier considered normal. This figure gradually went down to 800 PPM or less, signifying large savings in the refining process, obviating the need for such exacting operations in subsequent processing and ultimately assuring the production of a superior quality of refined oil.

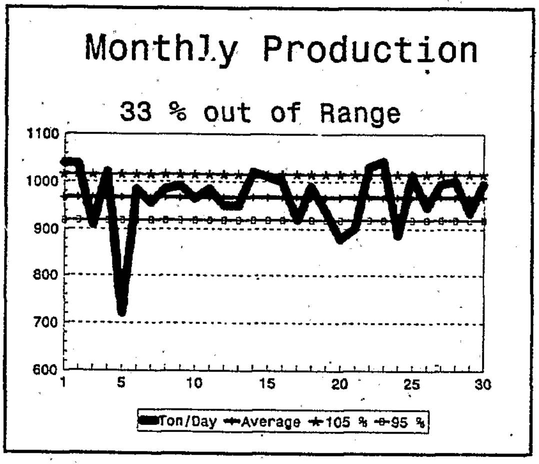
Meals: Whereas production in the past was characterized by low quality meals (low in protein and high in fibre), standards have risen to the extent that today the market not only offers products of a higher quality but is also in a position to satisfy a very diversified range of requirements. **Meal Quality.** In the graph you can see the different qualities of sunflower oil on the market today.

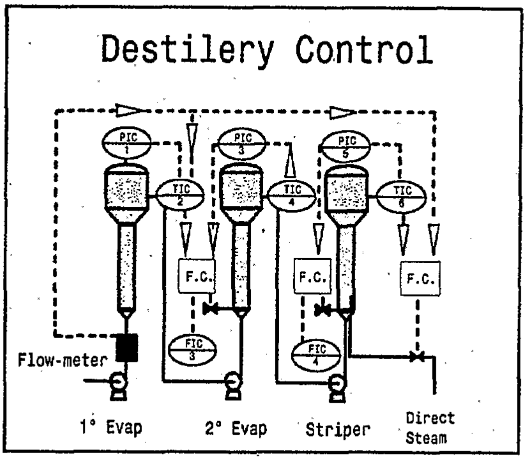
I hope that through my talk I have managed to convey a general panorama of the advances made in this area and which have led to a higher level of quality assurance. To recapitulate, it is necessary to ensure

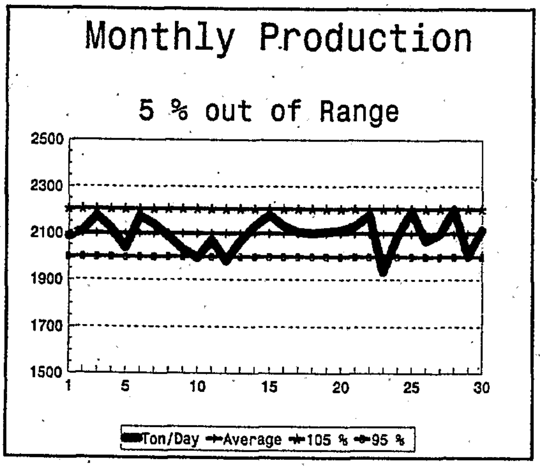
- The installation of adequate processing techniques
- Enforcement of the requisite controls for on-line and real time processes
- Automatic sampling and the rapid analysis of quality parameters
- Permanent training programmes
- The introduction and upholding of safety procedures
- The utilization of processes which are not conducive to pollution

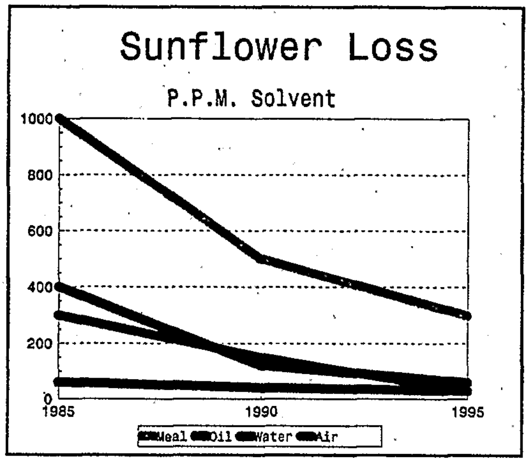
Thank you very much for your interest.

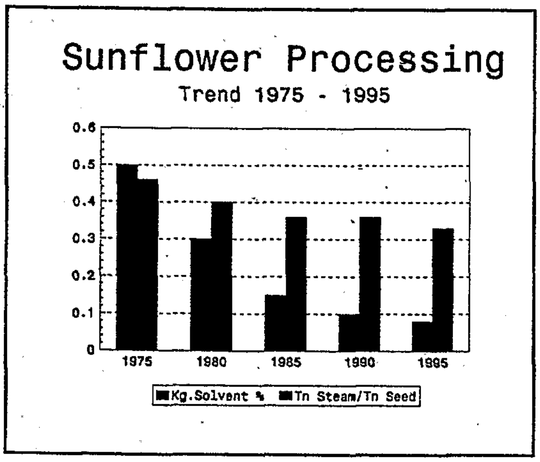
GRAPHS

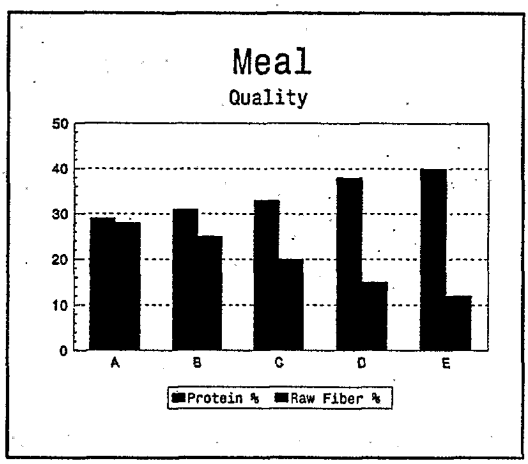

Monthly Production
33 % out of Range
1100
1000
900
800
700
600
1 5 10 15 20 25 30
Ton/Day Average 105 % 95 %


Destilery Control
PIC 1
PIC 3
PIC 5
TIC 2
TIC 4
TIC 6
F.C.
F.C.
F.C.
FIC 3
FIC 4
Flow-meter
1° Evap
2° Evap
Striper
Direct Steam


Monthly Production
5 % out of Range
2500
2300
2100
1900
1700
1500
1 5 10 15 20 25 30
Ton/Day Average 105 % 95 %


Sunflower Loss
P.P.M. Solvent
1000
800
600
400
200
0
1985
1990
1995
Meal Oil Water Air


Sunflower Processing
Trend 1975 - 1995
0.6
0.5
0.4
0.3
0.2
0.1
0
1975 1980 1985 1990 1995
Kg.Solvent % Tn Steam/Tn Seed


Meal
Quality
50
40
30
20
10
0
A B C D E
Protein % Raw Fiber %