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Seed quality in Italy with emphasis on red rice issues

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Abstract

The cultivation of rice seed in Italy extends over about 13,000 hectares out of about 233,000 hectares of paddy fields. More than 50,000 tons of seed are certified each year and more than 9,000 tons are exported towards other UE countries and Mediterranean ones. More than 90% of the rice surface in Italy is sown with certified seed, nevertheless red rice infests rice fields hence it is a major contaminant of rough rice.

Seed purity according to UE standards is now considered insufficient by many rice farmers to prevent red rice contamination of the fields.

The Authors briefly report the evolution of the European and Italian laws fixing certified seed standards.

Results of purity analysis of seed certified in the last four years are reported which show that more than 50% of the total amount of seed is free of red rice while a further 25% contains only one red kernel/500 g of rough rice. Possible reasons - other than seed purity - of the increasing red rice contamination are discussed.

The Authors also report and discuss some recent proposals in Italy to improve seed quality - hence production quality - decreasing impurity tolerance for certified seed.

Keywords

- Rice seed, quality, standards, red-rice
- Italy.

Introduction

Good quality seed is considered to be one of the main factors for growing a highly performing crop. In the last twenty years rice production in Italy has benefited by the increasing use of certified seed, at present more than 90% of the paddy fields are sown with certified seed. This could have happened since the price of rice seed is relatively low - about 30-40% more than rough rice price - thanks to the Community aid granted to the seed growers.

Italian rice seed is appreciated by European rice farmers, in fact about 20% of the production is sold to the other rice growing countries in the Community.

In recent years, red rice has increasingly infested paddy fields becoming a major contaminant of rough rice. Seed quality - namely seed purity - has sometimes been considered insufficient to prevent red rice contamination, moreover it has been accused for broadcasting red rice seed in the fields.

Following data will show the actual characteristics of Italian rice seed.

Rice seed production in Italy

Rice cultivation in Italy is mostly located in the Northern regions and extends over about 233,000 hectares. In the surroundings of the three towns of Vercelli, Novara and Pavia there is the main rice region where 90% of paddy fields are gathered. There rice industry is one of the most valuable agricultural industries.

Seed cultivation extends over about 13,000 hectares, 40% of the surface is located in areas where rice growing started in recent years and rice industry is a minor business. In those areas seed growing is going to increase further in the next years thanks to suitable conditions to support the production of pure and healthy seed.

Rice farmers are more than 6,100 and seed growers are 350 out of them. The average surface is 10-15 hectares for each seed crop.

The production of certified seed has increased for the last four years (table 1), together with the increase of rice area in Italy and the increase of the exported amount of seed.

Table 1 - Seed balance for the years 1993-1997

Year	Crop surface ha	Production ton a		Import ton b	Export ton c	Supply ton d=a+b-c	Rice surface ha e	Seed rate ton/ha d/e
1993	11.910	47.200,9		-	-	-	-	-
1994	12.457	48.322,6		942,5	5.945,4	42.198,0	235.951	0,18
1995	12.854	51.394,3		361,7	6.252,8	42.431,5	239.259	0,18
1996	15.027	53.389,5		400,5	9.093,0	42.701,8	237.551	0,18
1997	-	-		252,2	9.495,6	44.146,1	232.835	0,19

The average consumption of certified seed - as calculated in table 1- is about 180 kg/ha, that is quite a consistent figure for Italian rice cultivation. However it is worth to mention that, should a seed shortage of a variety occur, quite often rice farmers prefer to sow their own seed instead of growing a different variety. So it is a hard job for seed industry supplying the market with the exact amount of seed of at least 20 different varieties, whose demand can greatly change year after year.

The imported seed is less than 1% of the used seed, it is seed of the short-cycle variety Cigalon from France. An exception occurred in the years 1990-92 when 2,000 up to 3,000 tons of seed of the indica-type variety Thaibonnet were imported from Spain : at that time this variety was not grown in Italy.

Table 2 reports data concerning exported seed which is mainly purchased in the rice growing countries of the UE, however about 7% of it reaches other Mediterranean countries, namely Turkey and Morocco.

Table 2 - Seed export in the years 1996-1997

Variety	Export to UE		Export to Other Countries		
	1996 ton	1997 ton	1996 ton	1997 ton	Country
Ariete	2,716.3	2,588.5			
Baldo	2.0	1.5	110.0	40.0	Turkey
Balilla	309.5	164.9			
Drago	6.5			30.0	Turkey
Elio	1,017.8	54.2	48.0	232.0	Morocco
Koral	1,087.3	1,099.6		0.2	Morocco
Lido	806.4	511.2			
Loto	384.0	1,144.2			
Roma	92.3	196.1			
Selenio	11.0	86.8			
Thaibonnet	1,640.8	2,240.3	384.0	358.0	Morocco
Others	477.1	746.1		2.0	
TOTAL	8,551.0	8,833.4	542.0	662.2	

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EU and Italian rules and standards

The production and the marketing of cereal seed within the EU is ruled by the Council Directive n. 66/402 dated 14 June 1966. This Directive was adopted in Italy in 1971, it replaced the previous law issued in 1925.

The Directive states that rice seed may not be placed on the market unless it has been officially certified as "basic seed", "certified seed, first generation" or "certified seed, second generation". Seed of all categories can be marketed only in sufficiently homogenous lots and in closed packages. The packages must be labelled on the outside with an official label. The colour of the label is white for basic seed, blue for certified seed, 1st generation and red for certified seed, 2nd generation.

The definition follows of the three categories :

- Basic seed has to be produced under the responsibility of the breeder according to accepted practices for the maintenance of the variety, it is intended for the production of the certified seed, 1st and 2nd generation. This category may be subdivided by several generations prior to basic seed, the so called pre-basic seed. The label for the packages of pre-basic seed is white with a diagonal violet line.
- Certified seed, 1st generation has to be produced directly from basic seed (or pre-basic seed, if the breeder so requests), it is intended either for the production of seed of the category certified seed, 2nd category or for purposes other than the production of rice seed.
- Certified seed, 2nd generation may be produced from any of the previous categories, it is intended for purposes other than the production of rice seed.

For each category conditions are fixed to be satisfied both by the crop and the seed.

Official examinations are carried out to verify whether the above mentioned conditions are satisfied. In Italy Ente Nazionale Sementi Elette (E.N.S.E.) is the competent certification authority, acting under the responsibility of the Ministry of Agriculture.

Basically official examinations include field inspection and seed testing. Crop and seed quality are assessed checking different attributes as varietal identity, purity, germination, health.

Standards and conditions listed in the Directive have been amended several times since 1966, "in the light of the development of scientific or technical knowledge".

Main amendments and present standards are listed in table 3.

Table 3 : EU rules and standards for seed production

Reference	Seed category	Standard
CONDITIONS TO BE SATISFIED BY THE CROP		
		Wild rice
Commission Directive n. 87/120/EEC	Basic seed	n° 0 plant x m²
	Certified seed	n° 1 plant x 50 m²
CONDITIONS TO BE SATISFIED BY THE SEED		
Council Directive n. 66/402/EEC	All categories	Minimum germination 80%
		Red rice (n. of seed/sample)
Council Directive n. 66/402/EEC	Basic seed	1
	Certified seed, 1st gen.	2
	Certified seed, 2nd gen.	3
Commission Directive n.78/387/EEC	Basic seed	2
	Certified seed, 1st gen.	5
	Certified seed, 2nd gen.	10
Commission Directive n. 87/120/EEC	Basic seed	1
	Certified seed, 1st gen.	3
	Certified seed, 2nd gen.	5

At least one field inspection must be carried out to check varietal identity, varietal purity and the occurrence of harmful organism attacks.

For seed testing, samples must be drawn from homogeneous lots, the maximum weight of a lot is 25 tons and the minimum weight of the sample is 500 grams.

The Member States of EU may impose additional or more stringent requirements for the certification of seed produced in their own territory. It is worth to underline the main differences between the Community and the Italian requirements.

- No standard was fixed by the Community until 1987 concerning purity and red rice in the field. In Italy since 1973, ENSE adopted technical provisions for field inspection which fixed minimum varietal purity for basic seed (99.95%) and certified seed (99.9 and 99.8% for 1st and 2nd generation respectively). In the same year a national decree fixed the maximum percentage of red rice in the field for seed production of short grain varieties (0.025%) and long grain varieties (0.05%).
- The standard for red rice in the seed adopted by the Council Directive n.66/402 was never brought into force in the Member States of the Community, because at that time no lot of seed could satisfy those conditions. In Italy the decree dated 1973 fixed the maximum content of 2-5-5 red rice kernels for sample, respectively for basic and certified seed. This standard did not change in Italy not even in 1978 when the Commission Directive n.78/387/CEE was adopted. The Italian condition for red rice content remained more stringent. Moreover a new decree in 1987 amended the previous one and the standard for maximum red rice content became 1-3-5 respectively for basic and certified seed. The same standard was adopted some months later by the Commission Directive n. 87/120/CEE.
- Minimum germination standard is 80% according to the community Directive, however in Italy the standard has always been (and still is) 85%.

Seed analysis results

Data which follow are the results of official examinations of crop and seed by ENSE, according to Italian and EU rules and standards.

It is worth to remark that these data concern seed of 50 to 60 different varieties, however for half of these varieties seed production is less than 200 tons each.

Table 4 contains percentage of seed crops which have failed field inspection and amount of seed which has failed

certification for the last four years.

Table 4 : percentage of crop and seed failing official inspection

Year	Crop			Seed		
	inspected ha	rejected ha	%	tested ton	rejected ton	%
1993	12,403	493	3.97	47,237.8	149.3	0.32
1994	13,199	742	5.62	48,649.5	320.5	0.66
1995	14,160	1,306	9.22	51,597.7	203.4	0.39
1996	15,889	862	5.43	53,551.2	161.7	0.30

Only an over all very low percentage (5% on average) of the seed crops was rejected because of red rice, insufficient purity, pest, lodging, hail.

Less than 1% of the seed failed certification, mostly because it did not meet the germination standard.

Table 5 reports the data concerning red rice content of the seed samples examined for certification in the last four years, including samples which failed to meet the germination standard. For each category the total amount of seed is shown shared in percentage by number of red rice kernels. At the right of the bold line the percentages are shown of seed which failed certification because of red rice.

It is worth to point out some remarkable data :

- more than 50% of the seed was free of red rice, i.e. 27,000 to 30,000 tons of seed and most of them are sold for rough rice production (not for seed production).

- more than 80% of the certified seed, first generation and more than 70% of the second generation met red rice standard of basic seed. Most of the certified seed, first generation is sold for rough rice production (not for seed production).

- about 95% of the certified seed, second generation met red rice standards of certified seed, first generation.

- the amount of pre-basic seed largely increased in the last couple of years and its purity decreased. The reason was the release of many new varieties, for which certified seed is not immediately available. Some breeders chose to grow extra amount of pre-basic seed just for introducing the new varieties in advance to farmers. It means that the pre-basic seed with relatively lower purity (maximum 1 red kernel/500 g rough rice) is not used for seed production but for paddy production.

Table 6 contains data concerning red rice analysis of the seed of the top ten varieties ranked on account of the amount of seed certified in the last four year. The mean number of red kernel is reported summing up all the categories of seed. For seven varieties, the average is less than one in the last four years.

Conclusions

The results of the official controls, both crop and seed inspections, show the high quality of rice seed production in Italy.

Seed growing farms are highly specialised, they supply seed industry with a large amount of good quality product. Less than 10% of the seed crops fail to meet purity and health standards. This is a remarkable result since rotation is not a compulsory practice for seed production in Italy and seed purity is obtained by means of field inspections performed by skilled workers who remove heterogeneous plants and wild rice.

Moreover one third of the rough rice harvested from seed crops exceeds the demand of seed companies so that it is possible to choose the best stocks of each varieties to be processed and sold to rice farmers.

Analysis of red rice presence in the seed shows that more than 50% of it is free of red rice and another 25% contains only 1 kernel / 500 g of rough rice.

The results concerning red rice analysis for the certified seed, second generation, show that about 95% of it has not more than 3 red kernels / 500 g, i.e. the same characteristics fixed for the first generation. Often the seed labelled with the official red label for certified seed, second generation, was directly bred from basic seed. The red label assures that the seed cannot be used for further seed production, especially abroad, without breeder agreement.

On the basis of the positive results of the official examinations for seed certification, the proposal has recently been brought up in Italy to impose more stringent requirements for the conditions to be satisfied by the seed. The maximum number of red rice kernels per sample could be lowered as follows :

0	for pre-basic and basic seed,
1	for certified seed, 1st generation
3	for certified seed, 2nd generation

Seed growers and seed industry agree that this amendment is feasible, however the new standard should be adopted at the end of a five years interval with successive progressive measures starting from pre-basic seed and going on generation by generation.

The amendment is going to be discussed at the Ministry of Agriculture. Such a measure should be appreciated by rice farmers who often consider seed purity insufficient to prevent red rice contamination of the fields. Actually red rice contamination has spread all over the rice area and has grown worse year after year for the last decade. At the moment seed bank of red rice is very rich in the soil of many paddy fields, so that it is impossible to appraise the positive outcome of sowing high quality seed.

However data presented above suggest that certified seed produced in Italy could not have been the major cause of red rice contamination. As mentioned before, standards for certification have often been more stringent in Italy than in the rest of the EU. Moreover, the contamination has grown worse just after the entry into force of the last and more stringent amendment concerning red rice standard for certified seed. Likely other events but seed have contributed to increase red rice contamination, namely :

- release and cultivation of new semi-dwarf varieties less competitive against wild rice plants. Moreover tall plants of wild rice are easily manifest in a field of a short height variety;
- import of the seed of Thaibonnet variety. The purity of the seed was not always sufficient and the variety is a poor competitor against wild rice. In few years the surface grown with Thaibonnet has become 20% of the total surface.
- sowing in drills on dry soil, which is a method that enhances wild rice contamination;
- rice cultivation year after year on the same soil without rotation, especially in the traditional rice area.

In conclusion, crop and seed examinations assess the value of Italian rice seed for planting. After it is sown, however, quality seed shares with other factors the responsibility to produce an abundant, high quality crop.

Tables summary

Table 5 - Total amount of seed examined for certification in the years 1993-1997 shared (percentage) by category and number of red rice kernels (1 sample/lot ; 1 sample = 500 grams; 1 lot = max. 25 tons).

Year	Seed category	ton	Number of red rice kernels/sample 0	1	2	3	4	5	>5
1993	Pre-basic	271.6	93.7	6.3					
	Basic	1,743.0	89.9	10.1					
	1st gen	15,914.4	64.9	20.7	7.9	6.5			
	2nd gen	29,308.8	55.7	23.1	11.5	4.8	3.0	1.9	
	TOTAL	47,237.8	60.3	21.7	9.8	5.2	1.8	1.2	
1994	Pre-basic	218.5	92.2	6.5	2.4				
	Basic	1,885.3	93.4	6.6					
	1st gen	21,810.0	71.6	17.1	7.4	3.9			
	2nd gen	24,735.8	51.0	26.9	11.3	5.3	1.8	3.7	
	TOTAL	48,649.6	61.6	22.1	9.1	4.4	0.9	1.9	
1995	Pre-basic	746.1	93.9	5.8	*0.3*				
	Basic	1,788.6	93.0	6.6	*0.4*				
	1st gen	24,775.3	66.6	18.9	7.6	6.7	*0.2*		
	2nd gen	24,287.7	50.2	25.8	12.4	5.3	2.4	3.3	**0.6**
	TOTAL	51,597.7	59.9	21.8	9.5	5.7	1.2	1.6	0.3
1996	Pre-basic	910.2	60.9	35.7	3.4				
	Basic	2.021.7	78.3	19.3	2.4				
	1st gen	23,878.1	57.4	23.4	11.9	7.3			
	2nd gen	26,741.2	42.3	25.2	17.7	7.8	4.2	2.8	
	TOTAL	53,551.2	50.7	24.4	14.3	7.1	2.1	1.4	

Table 6 - Mean number of red kernels per seed sample of the top ten varieties (1 sample/lot ; 1 sample = 500 grams; 1 lot = max. 25 tons)

Variety	1993 number of samples	1993 mean n. of red kernels	1994 number of samples	1994 mean n. of red kernels	1995 number of samples	1995 mean n. of red kernels	1996 number of samples	1996 mean n. of red kernels
Thaibonnet	290	0.07	431	0.17	379	0.13	290	0.16
Loto	227	0.66	260	0.67	359	0.60	432	0.79
Ariete	274	*1.53*	210	*1.40*	217	0.96	216	*1.46*
Balilla	224	0.26	226	0.42	197	0.77	214	0.35
Drago	208	0.88	205	0.92	210	0.94	152	0.68
Elio	147	0.50	157	0.36	201	0.57	125	0.70
Volano	95	0.96	92	0.74	123	0.63	310	0.76
Lido	182	0.97	135	*1.11*	83	*1.07*	71	*1.10*
Baldo	105	0.84	109	0.57	126	*1.12*	136	*1.07*
Arborio	128	0.35	100	0.52	85	0.32	92	0.45

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