A new grain amaranth (*Amaranthus cruentus* L.) variety for temperate climates

UNIVERSITÀ DEGLI STUDI FIRENZE

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PATENT STATUS: Under CPVO evaluation (I year)

PRIORITY NUMBER: CPVO 2020/2434, application filed on October 2, 2020 as «UNIFI6161»

PUBLICATION: -

PUBLISHED AS: -

Invention

DAGRI, which has experience in the pseudocereals since 1999, has carried out genetic improvement resulting in the production of the new variety of *A. cruentus* currently called **UNIFI6161**.

Method used: Half-SIB selection of the access PI 649507.

Location: Tenuta di Cesa (Arezzo), 43 ° 18 'north; 11 ° 47 'east, 246 m asl.

Main characteristics:

- small size plants (1.5-1.7 m) relative to the average of the species;
- single apical panicle and absence of lateral branches;
- light colored seeds weighing 1000 units > 0.8 g;
- medium early cycle (150-160 days);
- good vigor of plants in the early stages of development;
- high content of protein, lysine, oil and squalene: 16.2%, 3.7%, 5.7-6.2% *, 8.5-13.5% * respectively;
- grain yield at 12% humidity ranging from 1.2 to 2.0 t ha^{-1}.

** Supercritical CO_2*

Drawings
& pictures

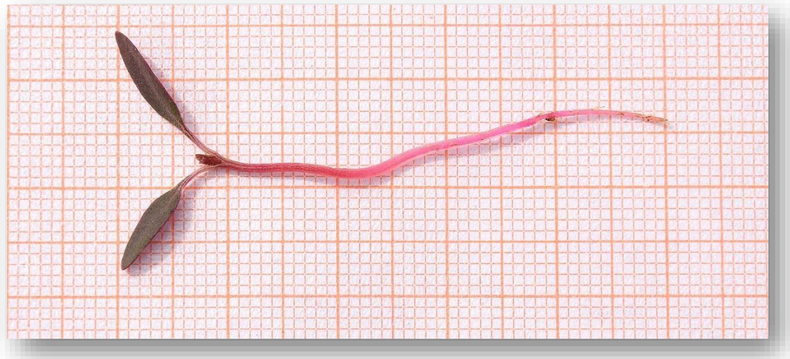
Crop at 50 days after emergence (ten true leaves).

Drawings & pictures

Plot during the 2019 selection.

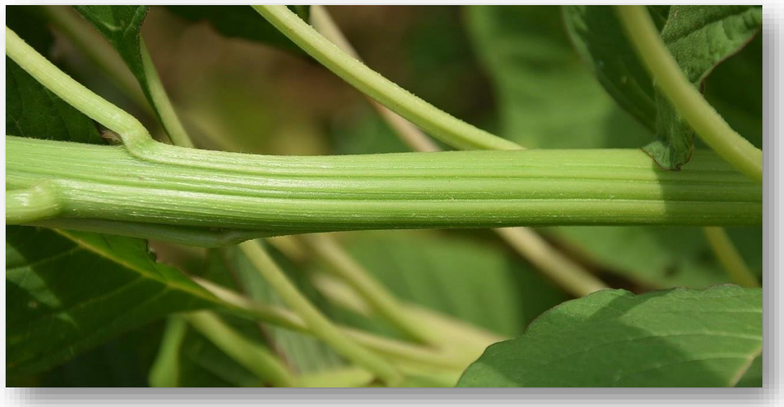
Panicle at full flowering.

Drawings & pictures

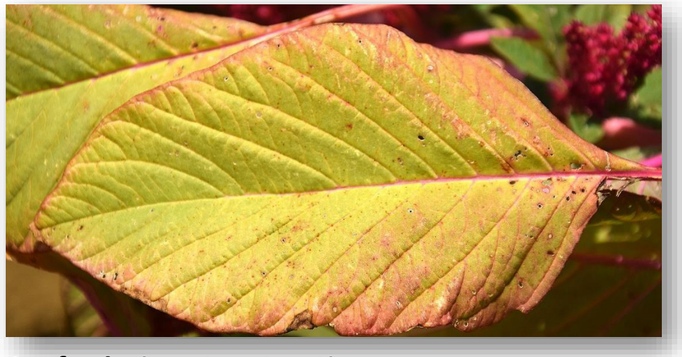


Seedling with cotyledonary leaves.

Leaf coloring and shape at flowering.



Stem coloring and shape at flowering.



Leaf coloring at maturation.

Stem coloring at maturation.

Detail of the density of glomerules.

Drawings
& pictures

Seeds soon after combine harvesting.

Seeds after selection and drying.

Industrial applications

The availability of a variety of grain amaranth suitable for temperate climates has an agronomic value and various industrial uses.

Economic value:

- Independence from imports of amaranth mainly from China and India and full control of the entirely national supply chain.

Agronomic value:

- Alternative species to opening the crop rotation, intended as an "improver plant" in accordance with the principles of classical agronomy. However, it does not require deep plowing (nor it is required in organic and biodynamic agriculture) and not even lavish fertilizations. Amaranth is a suffocating crop and considered it is a full-fledged "preparatory" species. The decision on whether to include the crop at the beginning of the rotation depends on the agro-environmental characteristics of the farm, its organization also in relation to the crops to be cultivated;
- Aridity tolerant species suitable for rainfed condition or with reduced water availability.

Industrial uses in the food sector:

- Amaranth, in addition to being the basis of a large number of food preparations for celiacs, is also used for the preparation of bars, snacks, muesli, puffed seeds, extruded and other products such as biscuits;
- flour does not contain simple sugars and this, given the high content of amylopectin and complex sugars, allows its use in the diets of obese and diabetic people;

Industrial applications

- drink based on amaranth ("vegetable milk") which, due to its excellent balance of amino acids and high calcium content, is suitable for feeding children, the elderly and lactose intolerant;
- starch is characterized by small granules (on average less than 1 µm) and polyhedral shape. Due to their size and therefore the large specific surface, the starch particles have a high absorption capacity and can be used as a thickener.

Industrial uses in the non-food sector:

- The cosmetic and pharmacological sector benefits above all from the high squalene content of the oil used as adjuvant in vaccines and in many cosmetic products;
- amaranth oil, with its content of tocopherols, compounds generally referred to as "E vitamin", together with squalene is used in the cosmetic industry especially in the skin and hair care sector and, more generally, in hypoallergenic formulations. The recognized properties are attributed to the high "anti-aging" antioxidant power.
- use of starch as a base for non-allergic aerosols and also as a substitute for talc.

Industrial applications

PUFFED SEEDS	WHOLE SEEDS					LEAVES	POLLEN
	Flour		Drinks	Soups	Oil		
Snack	Confectionery →	*Biscuits*	Beer	(Various)	Cosmetic products	Food coloring	Red blush
	→	*Pastries*					
	→	*Custard*					
Bars	Bread				Pharmaceutical products	Vegetable	Therapeutic use
Muesli	Pasta				Squalene	Forage	
Granola	Fermented and non-fermented beverages					Biomass	
Flour	«Milk»					Composting	
Extruses	Puddings						
	Sauces						
	Starch →	*Talc*					
	→	*Hypoallergenic aerosols*					
	→	*Gelatinizing*					

Summary of the uses of amaranth.

Possible developments

1. Creation of an entirely Italian/European supply chain of amaranth by lightening imports. Particularly important for the EU and in particular for Italy as the second world market for gluten-free products;

2. Provide a viable economically sustainable alternative to organic farmers and biodynamic farmers, as regards alternative crop to open crop rotation;

3. Future development of other varieties of amaranth (one of which is already in place at DAGRI) dedicated to particular processes such as **beverages**, **dyes** or **red sprouts**.

Other new potential DAGRI amaranth lines.

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