

Amaranth as a crop for a changing climate

Background

One of the most difficult aspects of climate change is the unpredictable levels of variability and extremes. In 2022, there were periods in June and July of extremely low rainfall, and consequently crops which have been traditionally considered dependable, such as runner beans, performed very poorly. Whilst we are not advocating replacing all our crops with alternatives, it pays to look at increasing our crop diversity to spread the risk. Amaranth is just one example of a crop that could be tried. Our experience of this is that it remains productive in hot weather and suffers from very few of the pests such as aphids, caterpillars and flea beetle that can plague traditional crops in hot summers.



Amaranth is cultivated in many countries around the world. It is grown both for its leaves which are eaten in a similar manner to spinach and its seeds which are eaten as a staple food like rice. It is thought to originate in South America, although it is now grown in many places around the world. In the UK, it is not commonly grown as a food crop but is used as an ornamental called 'Love lies bleeding' and is found as a weed in some areas of East Anglia. There are over 400 species of amaranth, and its ability to readily hybridise is thought to contribute to its adaptability.

The spinach-like leaves are a good source of iron, zinc and calcium and also contain reasonable levels of the essential amino acids lysine and methionine. The seeds of amaranth are either white, red or black. They have higher levels of proteins and a much better balance of essential amino acids than many other grain crops such as rice. However, only the white seeds are edible as the more common red or black seeds have an unpleasant bitter taste due to the high levels of tannins.

Although amaranth is not commonly grown commercially in the UK, it can be found grown on allotments and in gardens by many cultures including Gujaratis, Jamaicans and Bangladeshis where it is grown as a leaf crop. It has many different names including chauli (Gujarat), callaloo (Jamaica), data and dugi (Bangladesh). Different cultures favour different properties. Jamaicans favour greener varieties with large leaves. Bangladeshis like those with red and green multicoloured leaves and may also favour those with fat stems for putting in soups and stews.

Garden Organic collected home-saved seeds of many different varieties from cities in the UK including Coventry, Birmingham, Leicester, Nottingham and London. Many had been brought over to the UK decades ago, and have now adapted very well to our climate, as growers saved seed from the best performing varieties each year. The home-saved varieties consistently outperformed any varieties that we could obtain commercially.

In this experiment, we are testing 3 varieties:

Mrs McGhie is a pale green variety originally from Jamaica. She brought it over in the 1950s when she came over with the Windrush generation and has grown and saved seed from it in the Handsworth and Stechford districts of Birmingham ever since.

Bangladashi Data was grown and home saved by Islam on an allotment in Perry Barr in Birmingham. It is a vibrant multicoloured variety that is often favoured by the Bengali community.

Mr Jefwa is a Gujarati from Uganda and he originally collected his seed from New Zealand in 1990 but has grown it and home saved it ever since. The leaves are dark green, and the flowers form deep red plumes.

Aims of this experiment

The aims of this experiment is to compare the 3 varieties as a leafy crop in a wide range of locations around the country and evaluate whether people find it practical to grow and enjoyable to eat.

What we need from you:

Space: 3 x 1 m² plots close or next to each other, ideally with similar conditions.

Growing care: sowing, planting out and watering the plots

Measurements:

- Estimate Ground cover once a month
- Estimate time of flowering
- Estimate how much you harvested
- Cook it and tell us what you think
- Optional – if you are keen, try characterising the varieties using our key.

Included in this pack:

- Instructions
- Seeds
- Recording sheets

Instructions

- We recommend that you sow the amaranth into seed trays first to allow germination in a warm place and achieve even spacing.
- We have also included the instructions for direct sowing if you don't have the space to raise the plants first.
- Please grow the callaloo in the soil rather than pots if possible. You could use a glasshouse, tunnel or grow them outside. Amaranth grows best in a sunny location.

Bed preparation – Early May

- Prepare three plots each 1m x 1m as you normally would for direct sowing. It will need a fine tilth with most of the lumps and stones raked off. Amaranth does not need a highly fertile plot but will benefit from some compost being applied.
- In each plot, mark out 3 rows, with 30 cm between each row.

Either Sow in seed trays – Early May – recommended method

- For each variety use a tray with 30 cells each sized 2.5 – 3 cm (1 – 1.5”) cells filled with fine seed compost. Sprinkle the contents of the seed packet into the tray, divided evenly between the cells and cover with 5 mm (1/4”). Leave the trays in a warm light place. Amaranth seed can be tricky to germinate, so we have given you more than you need.
- Thin out the seedlings, when it is clear that you have one seedling in each module
- Once plants have developed true leaves, put the trays outside during the day to harden off. Amaranth will not tolerate frost.
- Transplant outside when the seedlings are 3 -5 cm high and have 3 true leaves, after the last frost.
- Plant 20 cm apart (ie 5 plants per row) in 3 rows to give a total of 15 plants for each variety

Or Sow seed directly – Mid May

- Draw 3 grooves 30 cm apart for each plot
- Water into each groove with a thin spouted watering can and allow to soak in.
- Divide the contents of the seed packet evenly between the rows
- Lightly cover the seeds and water in well.
- Keep the soil moist until all the seeds have germinated.
- Carry out an initial thinning to reduce crowding, then when the plants have started to develop 3 true leaves, thin the extra seedlings out so that you have 5 plants spaced at c 20 cm apart in each row giving 15 plants in each plot.

Plant care

Look after the plots as you would normally care for any other leafy crop – water a few times a week to prevent the soil becoming excessively dry, and keep the plot relatively weed free.

Ground cover measurement – June, July, August, September

At the beginning of each month, estimate the ground cover of each variety using the scale provided.

Measure the plant height just as it starts to flower. Measure from the base of the plant to bud tip on the main stem. Repeat for 5 plants and take an average.

Flowering – Late July / September

Please record the date when flowering buds start to appear. This is when the main stem stops producing leaves, and a bristly cone shape starts to emerge. In July and August, when you are still harvesting, removing the flowers will prolong leaf production. Eventually, the plant will produce many flowers from many side shoots and it becomes impossible to remove every flower.

Harvesting – July – September

- We are harvesting these varieties just for their leaves. Like many varieties, the seeds have high tannins and are not pleasant to eat.
- You can take harvests from your amaranth once it has reached a height of 30 cm
- Initially harvest the lower third of larger leaves.
- Once the plants reach a height of 50 cm you can cut off stems just above the second or third side shoot and they will regrow.
- We don't expect you weigh all of your produce as it is difficult to weigh leaves accurately with kitchen scales.
- Please keep a tally of how many salad bag size packs (200 g) that you harvested from each plot, also rank the 3 varieties

Taste test - August

At the end of August, harvest the leaves and steam for 5 minutes. Rate the varieties according to the key given.

Characterisation (optional) – July and September

- This will take a little more time and is optional. We are interested to see how consistently the characteristics hold out when grown under different conditions at different sites.
- You will need to do a leaf characterisation in July, when mature leaves are being produced but before the plant starts flowering.
- You can also characterise the flowering heads in September.

Recording sheets

Please note that it is not necessary to provide your name and address on the recording sheet.

Many thanks for your support and for taking part in this experiment.

By far the easiest way to send the data is to enter it online. The links to the forms are on this page.

www.gardenorganic.org.uk/what-we-do/citizen-science-and-research/members-experiments/amaranth-as-a-crop-for-a-changing-climate

You can now store results on the form as you go – it will email you a link, which you can then use to resume entering results. Please keep this email in a safe place so that you can retrieve the results. If you do lose it, then you will need to email me (experiments@gardenorganic.org.uk) and ask me for a new link.

or

you can return the record sheets to us by **31 March 2024** at the following address:

Members' Experiment Coordinator,

Garden Organic,

Ryton on Dunsmore,

Coventry

CV8 3LG.

Electronic versions of these instructions are available in the Members' Experiment section of our website:

www.gardenorganic.org.uk/members-experiments .

We welcome good quality photos. The best ones may be published in our magazine and on social media.

Please send photos to experiments@gardenorganic.org.uk. Unfortunately, we are unable to use hard copy prints.

Part 2 – Recordings at your site

Your site

What are the first 3 letters of your postcode?

Soil type			
<input type="checkbox"/> Very sandy	<input type="checkbox"/> Quite sandy	<input type="checkbox"/> Silty	<input type="checkbox"/> Mix of sand, silt and clay (loam)
<input type="checkbox"/> Some clay	<input type="checkbox"/> Heavy clay	<input type="checkbox"/> Peaty	<input type="checkbox"/> Chalky

Shading of plot		
<input type="checkbox"/> Shaded	<input type="checkbox"/> Semi shaded	<input type="checkbox"/> Sunny

Your plants

Sowing and emergence

What date did you sow the amaranth?

Did you sow them into trays or directly?	
<input type="checkbox"/> Trays	<input type="checkbox"/> Directly

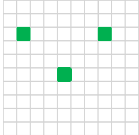
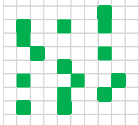
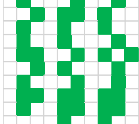
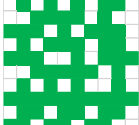
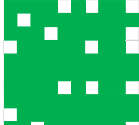
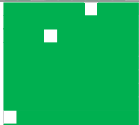
Did you grow the final plants outside or under cover (ie glasshouse or polytunnel)	
<input type="checkbox"/> Outside	<input type="checkbox"/> Under cover

What date did they first emerge?		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

If you grew the amaranth in trays, when did you plant it out?

Ground cover

At the beginning of each month give each variety a score for ground cover using the following scoring key:

Score	Range	Description	
1	0 – 5%	One or 2 plants present, very little there	
2	5 – 25%	Covering less than a quarter of the ground, not that much there	
3	25 – 50%	Covering up to half of the ground	
4	50 – 75%	Covering more than half of the ground but still some gaps	
5	75 – 95%	Covering most of the ground, only a few small gaps	
6	95 – 100%	Almost complete cover, gaps are very small	

Ground cover score in June (1-6) – see scoring scale above		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

Ground cover score in July (1-6)		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

Ground cover score in August (1-6)		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

Ground cover score in September (1-6)		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

Plant height

Please measure the height of 5 plants (cm) just as they are initiating flower buds and write down the average here		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

Flowering

Please estimate the date when <u>half of the plants</u> had started flowering		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

Please rank 1- 3. 1 = first to flower, 2 = second to flower, 3 = third to flower		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

Harvesting

No of salad bag portions harvested. Please keep a record and estimate the number of salad bag equivalents (c 200g) you harvested from each variety this season.		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

Taste test Please steam the amaranth for 5 minutes then taste

Please rate flavour of the 3 varieties					
	Very unpleasant	Unpleasant	Neutral	Pleasant	Very pleasant
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please rank the varieties in order of taste 1 = Best tasting, 2 = Next best, 3 = Worst taste		
Mrs McGhie	Bangladeshi Data	Mr Jefwa

Please rate tick any of the flavours that you associate with each variety					
	Bland	Bitter	Salty	Earthy	Grassy / leafy
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Did you experience any pests or diseases when growing amaranth?

Any other comments on amaranth?

Please rank the varieties in order of overall performance: 1 = Best variety, 2 = Second best, 3 = Worst		
Mrs McGhie	Bangladeshi Data	Mr Jefwa


Would you grow any of these varieties again?					
	Definitely not	Probably not	Perhaps	Quite likely	Definitely
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Characterisation

This is optional, it might look like a lot of questions, but shouldn't take long to do and can be fun!

The purpose is to see how much the characteristics vary with location.




Assess the mature leaves halfway up the stem, before the plant has started flowering. This will be in July




Leaf shape – position of widest part of leaf			
	Middle/slightly towards base	Moderately towards base	Strongly towards base
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Prominence of Leaf veins			
	Weak	Medium	Strong
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Main leaf colour					
	Light green	Medium green	Dark green	Red	Purple
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Secondary leaf colour (if any)					
	Green	Silvery	Red	Purple	None
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Distribution of colour			
			
	Coloured basal area	Central blotch	Leaf veins
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If central blotch, size in relation to blade			
			
	Small	Medium	Large
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Leaf margin		
		
	Entire	Sinnuate
Mrs McGhie	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>

Stems


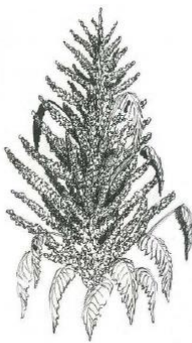

Dominant stem colour					
	Green	Yellow	Pink	Red	Purple
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>




Stem colour at base (where present)					
	Green	Yellow	Pink	Red	Purple
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

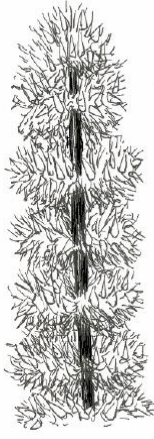


Plant growth		
	Determinate – compact, stops growing after first flower	Indeterminate – continues to grow and produce branches after flowering
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>

Flowers (measure in September)

Flower colour					
	Green	Yellow	Pink	Red	Purple
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Compactness of flower			
			
	Compact	Intermediate	Open
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Inflorescence attitude			
	Upright/weakly curved	Moderately recurved	Strongly recurved
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Density of glomerules (observe the branches on the main flower)			
	Upright/weakly curved	Moderately recurved	Strongly recurved
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Seed colour	White	Yellow	Brown	Pink	Black
Mrs McGhie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladeshi Data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mr Jefwa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please answer the following questions about members experiments.

Please tick which of the boxes you think applied to your experience of taking part in the members' experiments this year.					
	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I enjoyed taking part in this experiment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I felt I learnt something new	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I felt I was contributing to something useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am likely to take part again	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other comments					
Any suggestions for future Members experiments					