Rootstocks: A key tool in adapting to climate change

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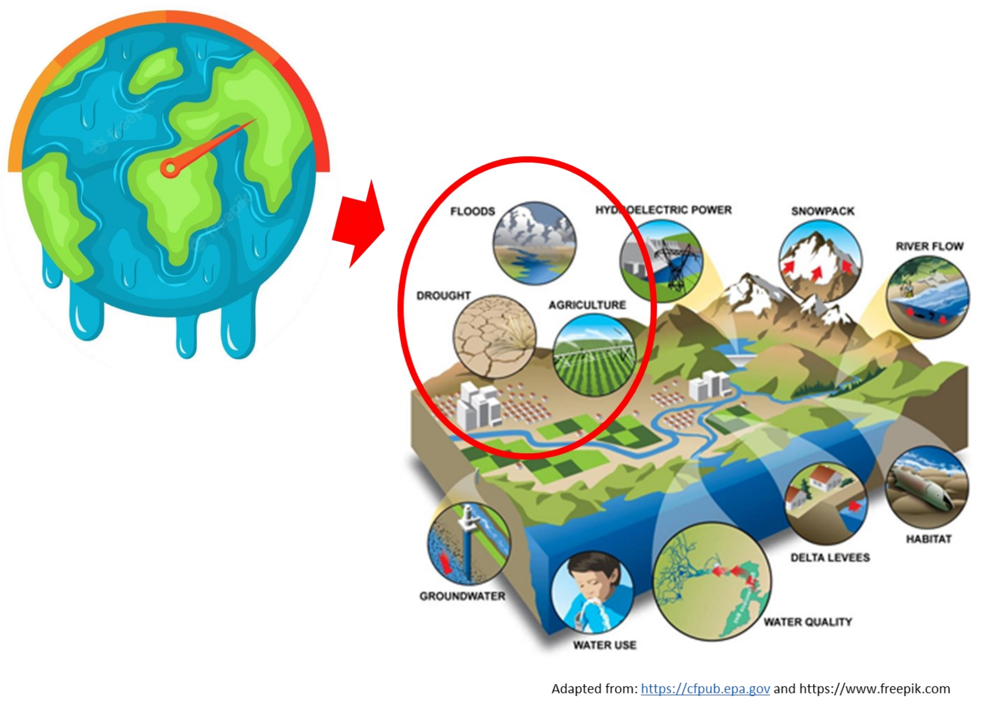
Introduction

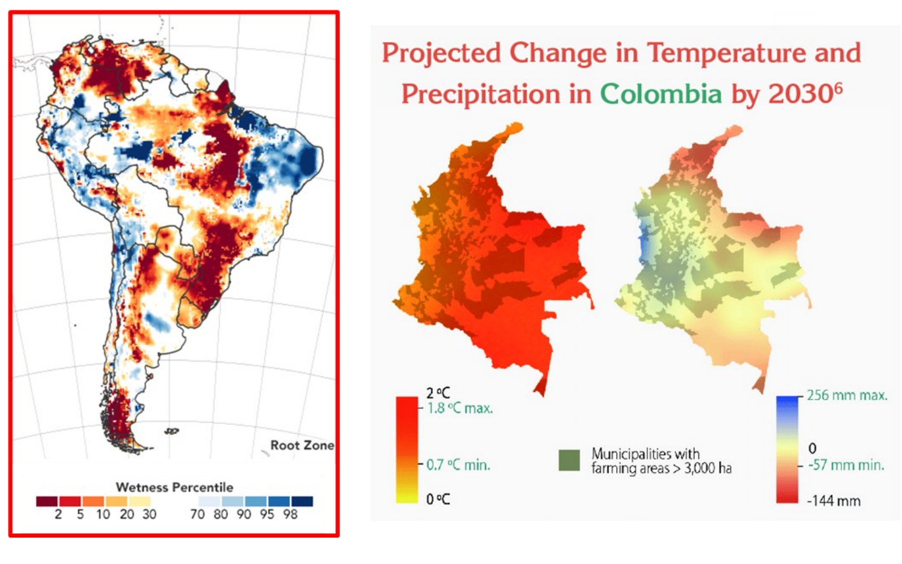
Figure 1. Climate change effects and its impact on agriculture.



Adapted from: https://cfpub.epa.gov and https://www.freepik.com

Climate change threatens our ability to ensure global food security, eradicate poverty and achieve sustainable development. Climate change has both direct and indirect effects on agricultural productivity including changing rainfall patterns, drought, flooding and the geographical redistribution of pests and diseases.

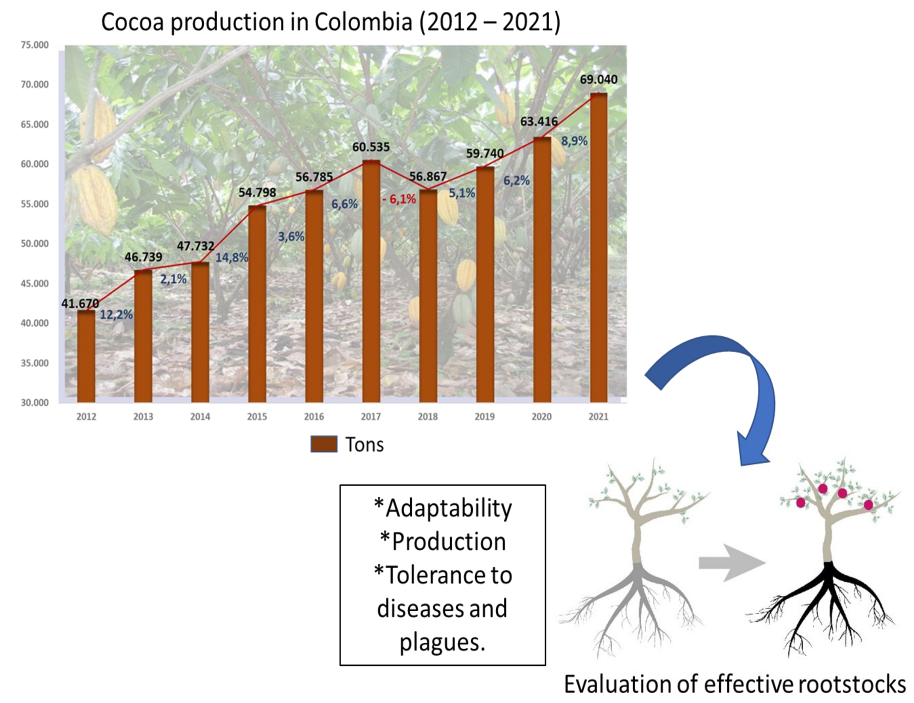
Figure 2. Spatial distribution of precipitation regimes and temperature prediction



Adapted from: https://www.nature.com/articles/s41467-020-16757-w and https://earthobservatory.nasa.gov

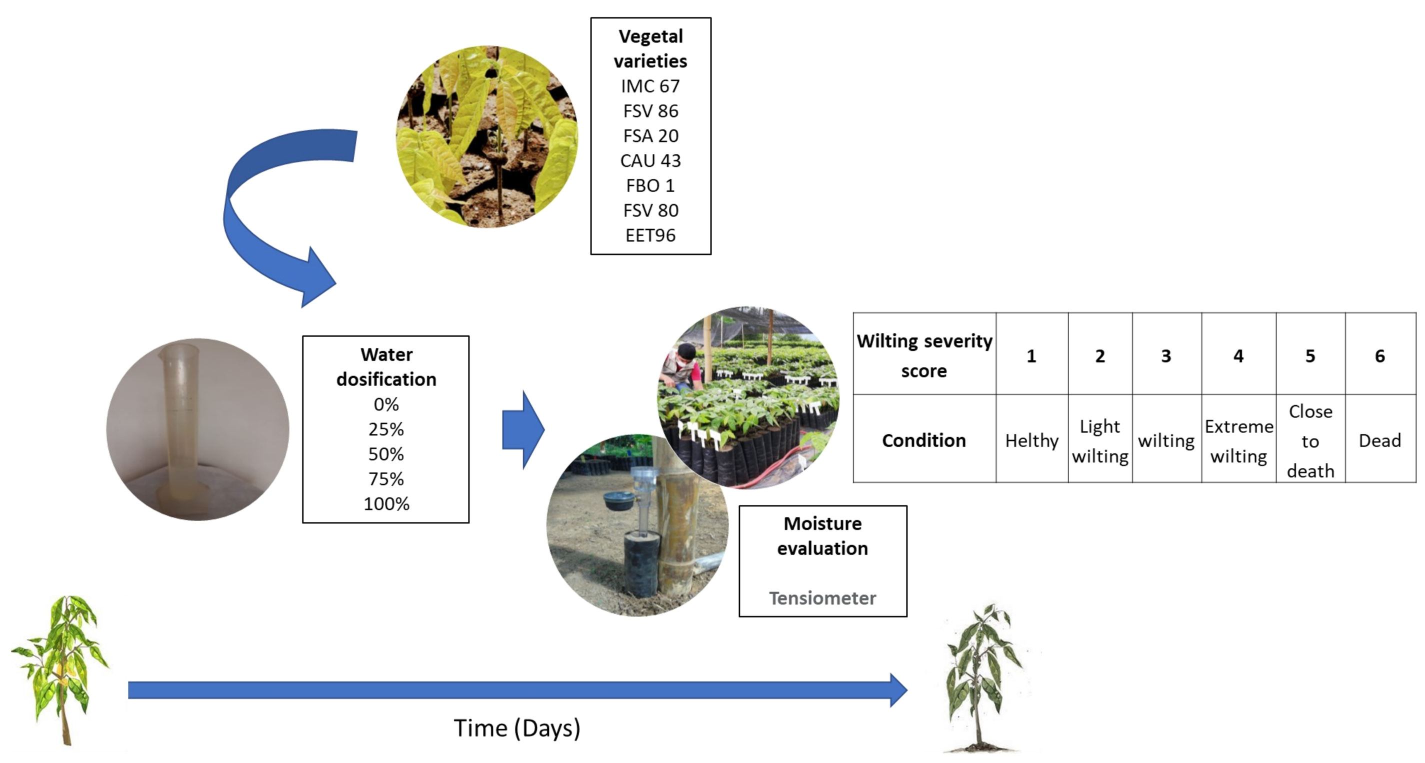
Climate change will increase both drought and excessive rains generating a decrease in the availability of water for food production, with negative consequences for agriculture, as worsening erosión and even damage to crops themselves.

Figure 3. Challenges for *T. cacao* materials according market demands.



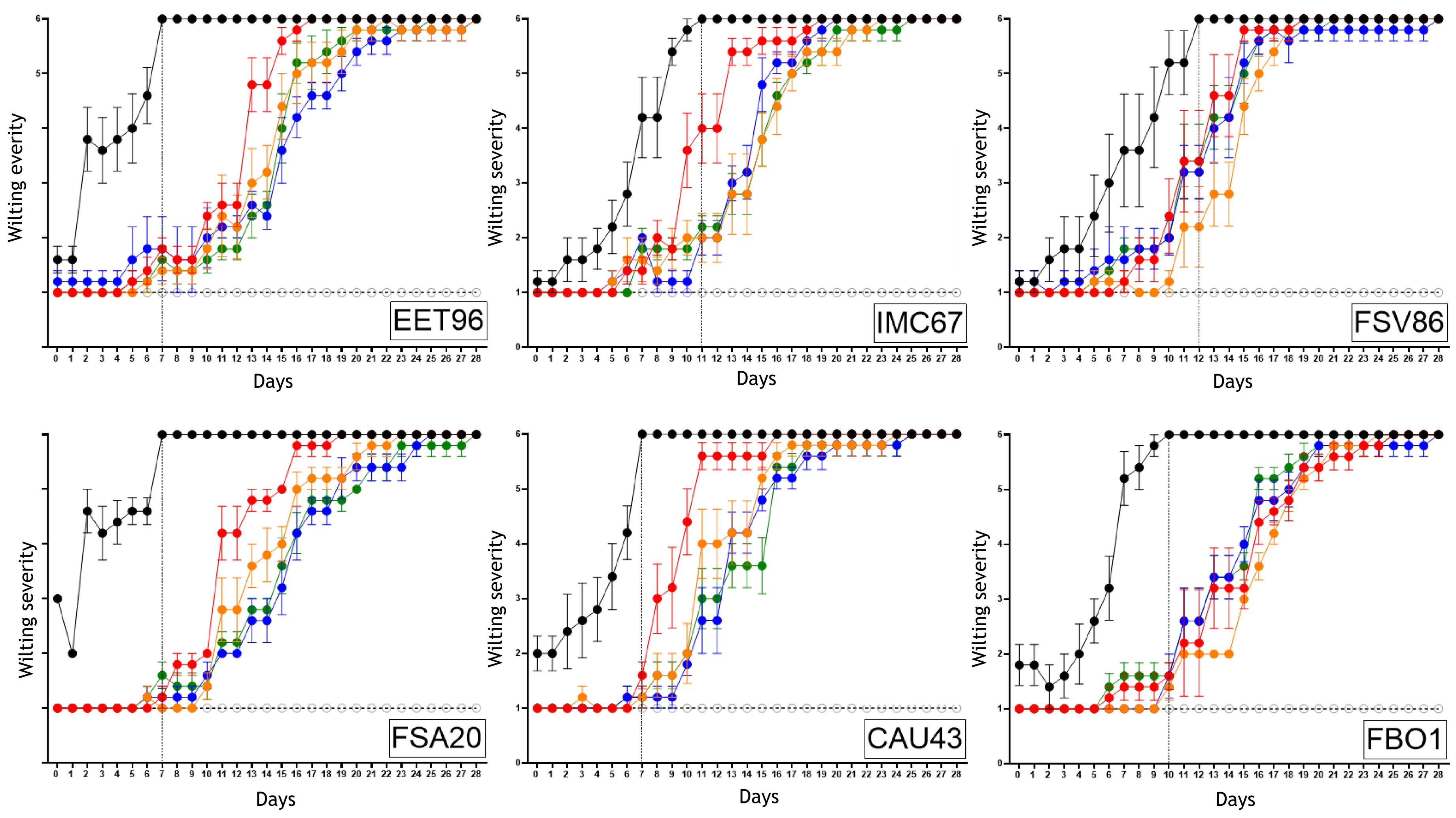
Demand imposes the need to select new genotypes with favorable attributes to preserve the genetic base and the adaptation to climate change effects.

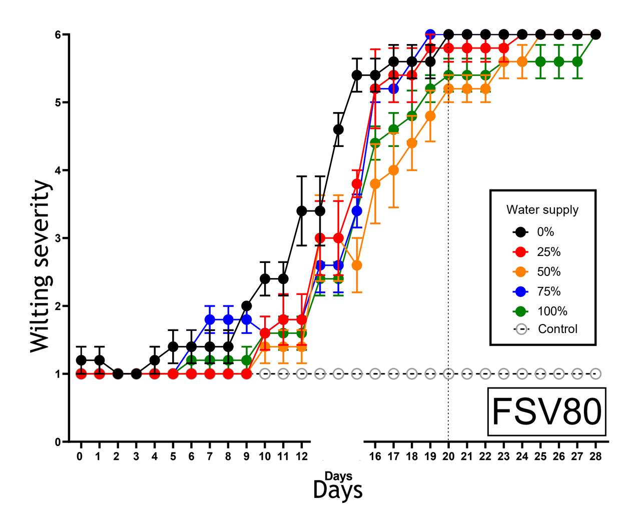
Materials and methods



Results

Figure 4. Wilting severity kinetics of different water stress conditions in *T. cacao* rootstocks.





Rootstock	Water tolerance (Days to get wilt) 25%	Water tolerance (Days to get wilt) 50%	Water tolerance (Days to get wilt) 75%	Water tolerance (Days to get wilt) 100%	Dought tolerance (Days to get wilt)
EET96	16	19	23	23	7
IMC67	18	23	20	24	11
FSV86	15	18	18	16	12
FSA20	16	21	24	23	7
CAU43	10	16	18	18	7
FBO1	21	21	19	19	10
FSV80	19	25	19	23	20

Table 1. Statistic comparison of water stress tolerance between seven evaluated rootstocks availables in Colombia.

Water supply	**0%**		**25%**		**50%**		**75%**		**100%**	
Tukey's multiple comparisons test	**p**	**Adjusted P Value**	**p**	**Adjusted P Value**	**p**	**Adjusted P Value**	**p**	**Adjusted P Value**	**p**	**Adjusted P Value**
EET 96 vs. FSV 86	****	<0.0001	ns	>0.9999	ns	>0.9999	****	<0.0001	****	<0.0001
EET 96 vs. CAU 43	ns	0.6265	****	<0.0001	***	0.0001	*	0.0401	*	0.0492
EET 96 vs. FBO 1	****	<0.0001	****	<0.0001	***	0.0007	ns	>0.9999	ns	0.5048
EET 96 vs. FSV 80	****	<0.0001	****	<0.0001	****	<0.0001	ns	0.705	**	0.0011
FSV 86 vs. FSA 20	****	<0.0001	ns	0.9975	ns	>0.9999	****	<0.0001	****	<0.0001
FSV 86 vs. CAU 43	****	<0.0001	****	<0.0001	***	0.0004	ns	0.1154	*	0.0125
FSV 86 vs. FBO 1	**	0.0037	****	<0.0001	***	0.0002	****	<0.0001	***	0.0002
FSV 86 vs. FSV 80	****	<0.0001	****	<0.0001	****	<0.0001	***	0.0009	****	<0.0001
FSA 20 vs. CAU 43	**	0.0037	****	<0.0001	***	0.0004	****	<0.0001	****	<0.0001
FSA 20 vs. FBO 1	****	<0.0001	****	<0.0001	***	0.0002	ns	0.1457	***	0.0004
FSA 20 vs. FSV 80	****	<0.0001	****	<0.0001	****	<0.0001	**	0.0028	ns	0.653
CAU 43 vs. FSV 80	****	<0.0001	****	<0.0001	****	<0.0001	ns	0.7645	****	<0.0001

* $p \leq 0.05$

Conclusions

Different patterns of water stress tolerance were identified between the evaluated rootstocks, however, FSV80 showed better tolerance levels to drought and a high adaptability to different water availability conditions.

IMC67, FSA20, FSV80 showed the best adaptation and tolerance to water excess suggesting a potential use in soils exposed to water excess or flooding risks.

Observed results could be used as an orientative resource for farmers, however, they must be correlated into the field and under different conditions like altitude, temperature, etc.

The presented results represent an approach for adaptation and mitigation of the climate change effects, to ensure and Smart-climate agricultura, climatic resilience and food safety.

References

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