



# Potential of recurrent selection for developing improved cocoa varieties in Ghana

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# **Posnette's introductions the basis of cocoa production in W/Africa**

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**Parentage analyses revealed few clones in the Amelonado, Marañon, Nanay and Iquitos genetic groups form basis for current production**

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**Expanding the genetic base beyond Posnette's introductions slow, partly due to the Seed Garden system of breeding**

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**Seed Gardens clones are only a few generations of genetic recombination from the original trees in the Amazon forest**



# **Recurrent selection adopted to develop clones improved for the major traits**

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**Additive gene action contributes in large part for most traits in cocoa**

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**Recurrent selection an appropriate strategy to increase frequency of genes for key traits**

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**Objective: develop productive clones and those with good combining abilities through cycle of clone evaluation and progeny testing**



# **Methods – 60 ortets selected from 11 families and evaluated for key traits**

**Ortets obtained from families in 11 progeny trials**

**Criteria: High bean yield of family, low black pod and CSSVD free symptoms for ortet**

**Key traits: Pod value, black pod incidence and yield**

**Reaction to CSSV infection in a gauzehouse facility**



# **Methods – progeny testing of selected clones done in on-station and on-farm**

**GCA of 7 of the clones tested with 5 international clones in crosses with Seed Garden females**

**Data collected on growth and yield traits up to the 7<sup>th</sup> year**

**Performance of specific crosses were validated in farmers' plots**



**The top 15% of new clones out-performs the standards**

**Range for yield (years)**

- **3rd & 4th : 119 – 614**
- **5th : 125 – 1066**
- **6th : 53 – 1089**

**Yield efficiency (YE):**

**1.9 – 18.6**

**Bean weight: 0.9 – 1.52**

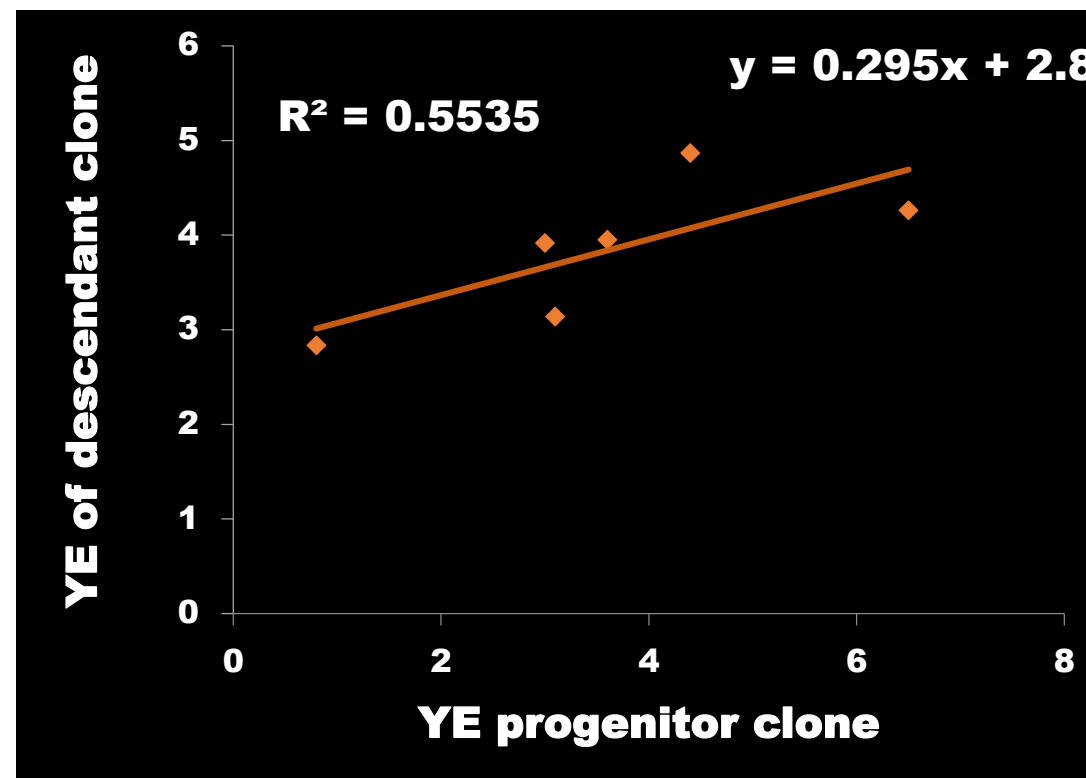
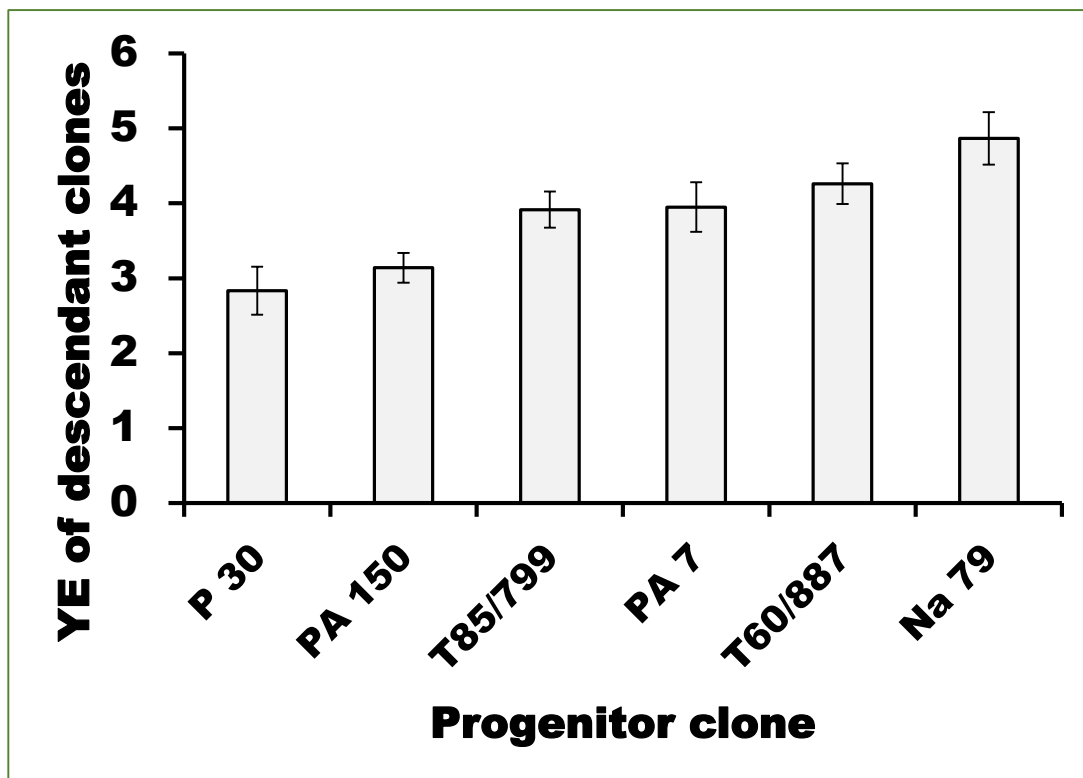
**Pod value: 17 – 35**

Clone	Yield for diff years (kg/ha)			YE (g/cm <sup>2</sup> )	Bean weight (g)	Pod value
	6 <sup>th</sup> year	5 <sup>th</sup> year	3 <sup>rd</sup> & 4 <sup>th</sup> years			
CRG 6035	1089	989	614	18.6	1.11	25
CRG 2029	778	868	554	15.4	1.08	25
CRG 9006	717	1066	571	17.3	1.22	22
CRG 8914	694	898	381	17.3	1.20	20
CRG 3015	674	671	320	10.6	1.28	23
CRG 6031	625	818	476	17.9	1.15	23
CRG 9005	548	843	380	16.8	1.24	23
CRG 2022	421	486	272	7.5	1.12	26
PA 7	495	334	238	6.0	1.06	33
T60/887	399	590	454	10.8	1.12	29
PA 150	315	347	188	7.3	1.27	27
SED <small>df = 162</small>	147.4	134.7	83.3	1.76	0.07	1.3



# Few clones accounted in large part for the variation in the base population

**The yield efficiency of progenitor clones was predictive of that in selected clones**

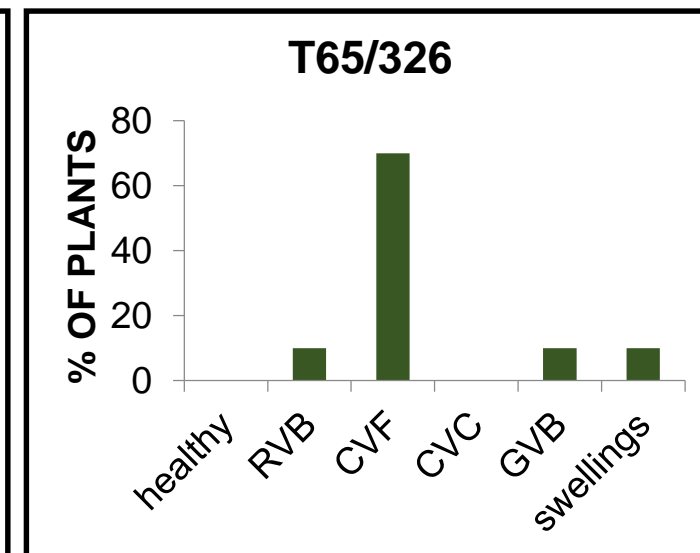
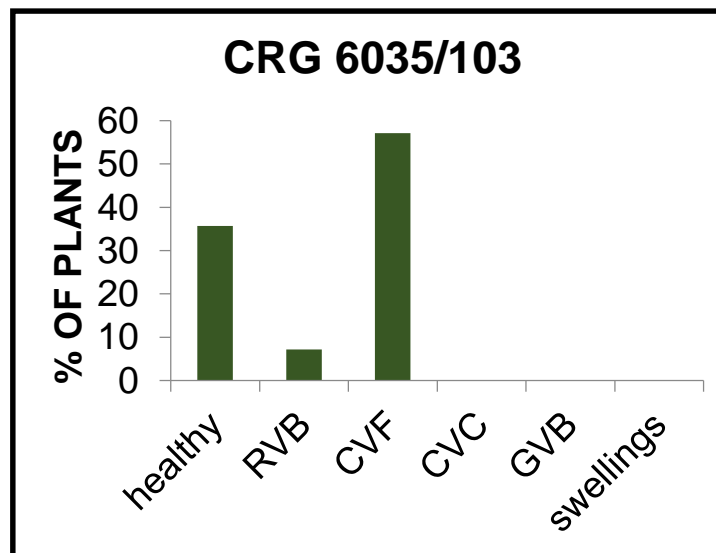
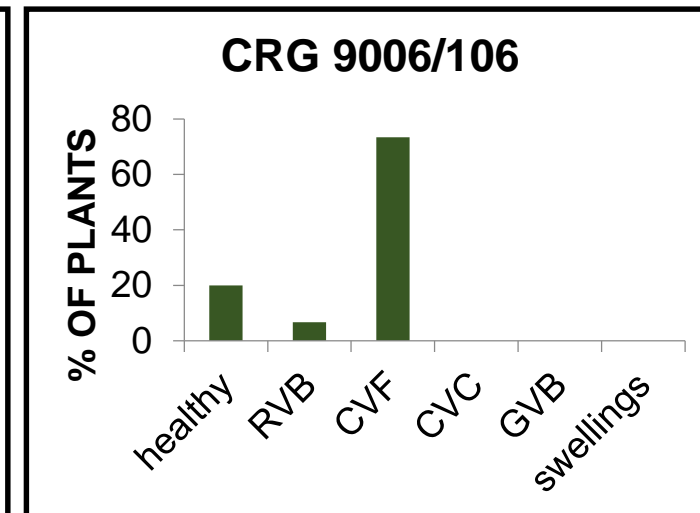
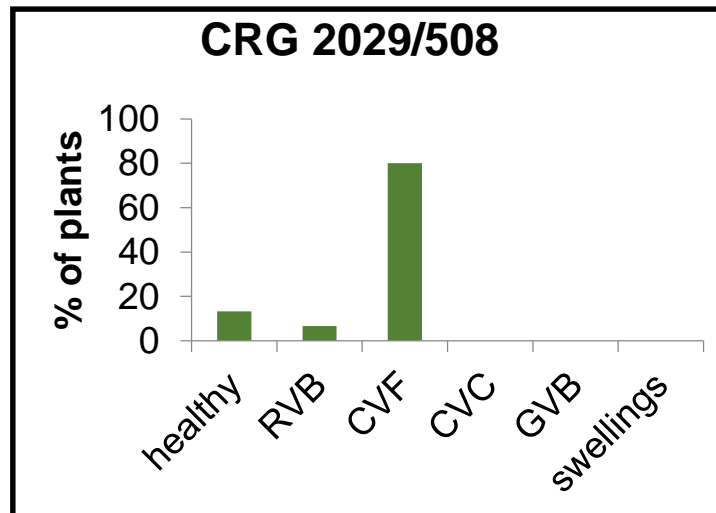




**Resistance to CSSVD in the top 3 clones better than one of the best known clones**

**The new clones combined resistance to infection with less severe symptom expression compared to the standard clones**

**It is possible that healthy plants expressed high levels of latency**







## Bean yield and black pod incidence among selected crosses compared favourably with the best specific crosses

- **Five of the selected clones combined well with existing seed garden females**
- **Performance across farmers' plots was consistently higher than the standard "mixed hybrid" variety from the Seed Gardens**

Progeny	Yield (t/ha/year)	Black pod (%)
PA 150 × CRG 3019	1.35 ±0.23	9.4 ±1.5
T60/887 × CRG 6035	1.34 ±0.22	23.3 ±4.6
PA 7 × CRG 6035	1.24 ±0.18	15.0 ±5.0
CRG 03 × CRG 9006	1.19 ±0.21	14.2 ±1.1
PA 150 × CRG 9006	1.16 ±0.18	12.9 ±4.2
T60/887 × CRG 9006	1.00 ±0.16	10.2 ±3.6
PA 150 × CRG 6035	0.99 ±0.14	10.7 ±2.4
CRG 03 × CRG 6035	0.99 ±0.16	18.1 ±3.2
PA 150 × POUND 7	1.07 ±0.24	16.9 ±6.2
T85/799 × P30	0.74 ±0.14	9.7 ±3.8
SED df = 721	0.12	5.4



## **Concluding remarks – scope for developing improved clones with available resources**

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**Though the genetic base is narrow, the yield potential in the early introductions remains under-exploited**

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**About 1000 clones in 8 genetic groups available in the CRIG collection offers scope for broadening genetic base in the next cycle of crossings.**

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**SNP fingerprinting necessary to avoid mating closely related individuals**

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**The current clones selected present significant gains over the early introductions**



Thanks for your attention

