PREDICTION OF BREEDING VALUE AND ESTIMATION OF VARIANCE COMPONENTS IN SPAIN BY MIXED MODELS.

1983. Sire Model (unpublished results).

1986. Animal Model (unpublished results).

1987. REML - EM (Sire Model).

1988. Animal Model (Official catalogue).

1992. Changes in the model:

- New definition of Contemporary Groups.
- Days-open effect.
- Heterogeneity of variance correction.
- P.E.V. (modified Meyer, 1989).
- Genetic grouping (origin by sex and age).

CONTEMPORANY GROUP (CG). TREATMENT AND DEFINITION.

RESULTS FROM SIMULATION (UGARTE et al., 1992).

C.G. RANDOM IMPLIES SOME GOOD PROPERTIES:

- ↓ PREDICTION ERROR VARIANCE.
- ↓ MSE WHEN G.C. > 4.
- ↑ GENETIC CORRELATION BETWEEN PREDICTED AND TRUE BREEDING VALUE.

RESULTS FROM REAL DATA. (BEN GARA AND ALENDA, 1992).

G.C. RANDOM IMPLIES:

* GOOD PROPERTIES:

- ↑ CORRELATION PEDIGREE INDEX - YD

- ↑ EFFECTIVE NUMBER (N_e)/REAL NUMBER (N_r)

- ↑ N_e/σ^2_e

* BAD PROPERTIES:

- ↑ CORRELATION PREDICTED B.V. - C.G. EFFECT.

- B.V. OF BULLS USED IN good environment POSITIVE C.G. EFFECTS ARE OVERESTIMATED.

ERROR VARIANCE (σ^2_e), COEFFICIENT OF DETERMINATION (CD) AND RATIO OF EFFECTIVE SIZE (N_e) AND ERROR VARIANCE FOR THE MODELS THAT CONSIDERED HERD-YEAR AND HERD-YEAR-MOBILE SEASON AS FIXED OR RANDOM.

MODEL		σ^2_e	CD	N_e/σ^2_e
HERD-YEAR	FIXED	1,465,300	.42	.044
	RANDOM	1,310,610	.48	.050
HERD-YEAR-SEASON (MOBILE)	FIXED	1,026,250	.62	.057
	RANDOM	1,026,500	.62	.061

WITHIN HERD CORRELATION BETWEEN PEDIGREE INDEX (PI = 1/2 B.V. SIRE + 1/2 B.V. DAM) AND YIELD DEVIATION (YD) FROM HERD CONTEMPORARY.

MODEL		CORRELATION PI - YD
HERD-YEAR	FIXED	.28
	RANDOM	.38
HERD-YEAR-SEASON (MOBILE)	FIXED	.27
	RANDOM	.40

EXPECTED WITHIN HERD CORRELATION PI - YD = .42

CORRELATION BETWEEN SIRE PREDICTED BREEDING VALUE (BV) AND CONTEMPORARY GROUP (CG) ESTIMATED EFFECTS.

MODEL		CORRELATION BV - CG
HERD-YEAR	FIXED	.07
	RANDOM	.34
HERD-YEAR-SEASON (MOBILE)	FIXED	.14
	RANDOM	.36

CONCLUSIONS:

1. USE OF C.G. AS RANDOM EFFECTS IN H-FRIESIAN EVALUATION IN SPAIN IS NOT RECOMMENDED (H_f + $YS(H)_r$?).

2. MOBILE HYS DEPENDING ON HERD SIZE IMPLEMENTED FOR NEXT EVALUATION.

HETEROGENEITY OF VARIANCE CORRECTION

- MANAGEMENT GROUPS (MG) WITH AT LEAST 30 OBSERVATIONS WERE CREATED FROM SIMILAR CONTEMPORARY GROUPS (C.G.) WITH A MAXIMUM OF 3 C.G.

- STANDARD DEVIATION FOR MG (σ_{MG}):

$$\sigma_{MG_i} = \left[\frac{N_i V_i + 30 PV_i + .5 N_{i-1} V_{i-1} + .5 N_{i+1} V_{i+1}}{N_i + 30 + .5 N_{i-1} + .5 N_{i+1}} \right]^{1/2}$$

N_i = NUMBER OF OBSERVATIONS IN MG_i.

V_i = VARIANCE OF MG_i.

PV_i = PREDICTED VARIANCE OF MG_i.

$$PV_i = (CV_{pop} * \mu_i)^2$$

CV = COEFFICIENT OF VARIATION (0.19 IN SPANISH POPULATION)

μ_i = PHENOTYPIC MEAN OF MG_i

(BAGNATO AND JENSEN PERSONAL COMMUNICATION)

IMPROVEMENT OF COMPUTING ALGORITHMS

- G.S. (100 ITERATIONES) CURRENTLY USED TO SOLVE BLUP-ANIMAL MODEL MME.

  - G.S. SLOW TO CONVERGE
  - UNCERTAINTY ABOUT STOPPING POINT

- SIMULATION APPLIED TO:

  - COMPARE NUMERICAL ACCURACY OF 6 ITERATIVE PROCEDURES:

    - GAUSS-SEIDEL (GS)
    - JACOBI-CONJUGATE GRADIENT (JCG)
    - SUCCESIVE OBERRELAXATION (SOR)
    - SYMMETRIC SOR - CONJUGATE GRADIENT (SSORCG)
    - BLOCK (200 ECUATIONS) (BLO)
    - BLOCK (FIXED EFFECTS + 200 EQ) (BLOF).

  - STUDY "ACCURACY OF PREDICTIONS" DURING ITERATION UNDER THE 6 PROCEDURES

  - DETERMINE STOPPING CRITERIA BY COMPARING PROGRESS OF ACCURACY OF PREDICTIONS AND ESTIMATED GENETIC TREND WITH NUMERICAL CRITERIA USED TO MONITOR CONVERGENCE.

- DATA SETS:

  - 2 SIZES (5000, 20000)

  - SELECTED vs UNSELECTED

- NUMERICAL CRITERIA: $Cd=\frac{\|b^{n-1}-b^{n}\|}{\|b^{n}\|}$ (Cb = y)

$$Md=\max|b^{n-1}-b^{n}|$$

$$Cp=\frac{\|b^{n}-b\|}{\|b\|}$$

- ACCURACY OF EVALUATION: - ρ_{TI}

- MSD = $\frac{\Sigma(\hat{u}_i-u_i)^2}{n}$

(u_i=additive genetic value)
(n=number of animals evaluated)

- ESTIMATED GENETIC TREND (b)

CONCLUSIONS:

- JCG AND BLOCKING ALLOW MORE NUMERICAL ACCURACY BUT LARGER MEMORY (4x) AND CPU TIME (4-5x) REQUIRED.

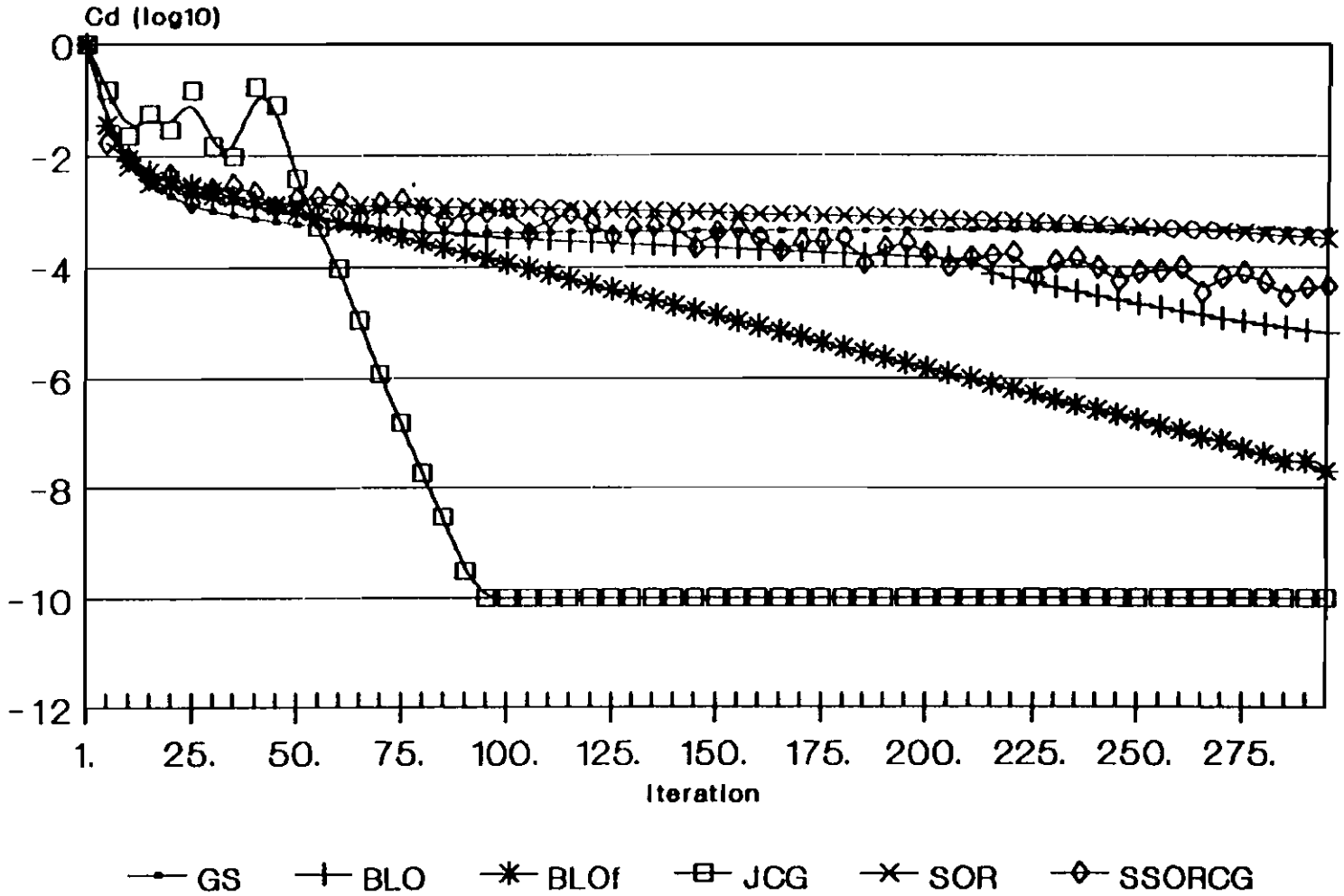
- FIXING RANKING DOES NOT REQUIRE HIGH NUMERICAL ACCURACY ($C_d \geq 10^{-3}$).

- OBTAINING STABLE MSD AND b REQUIRED MORE NUMERICAL PRECISION ($C_d \geq 10^{-4}$).

- SLIGHTLY SLOWER CONVERGENCE FOR SMALLER AND SELECTED DATA SETS.

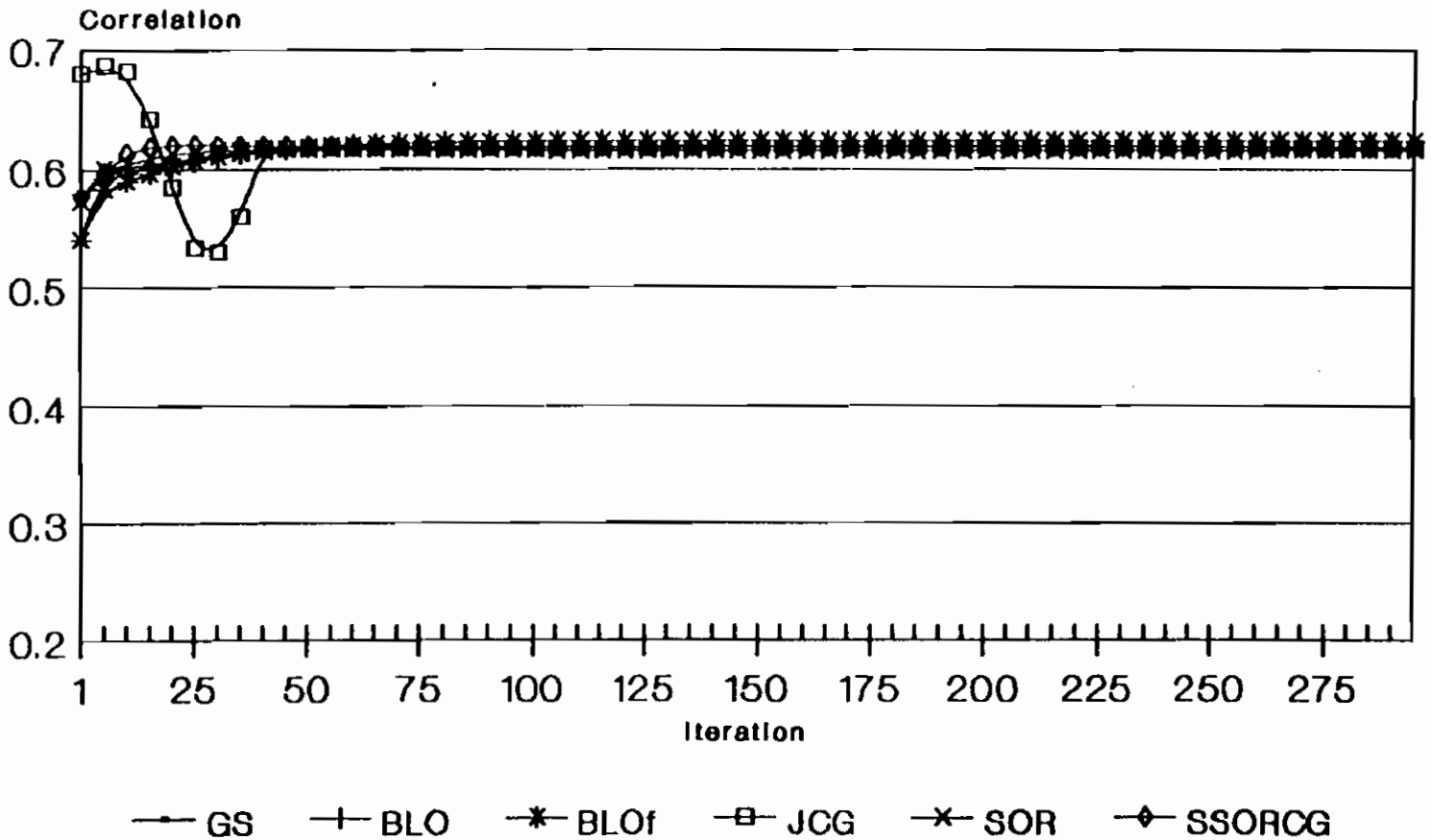
- POSSIBLE SHIFT TO JCG FOR FUTURE EVALUATIONS.

Changes in Cd during iteration



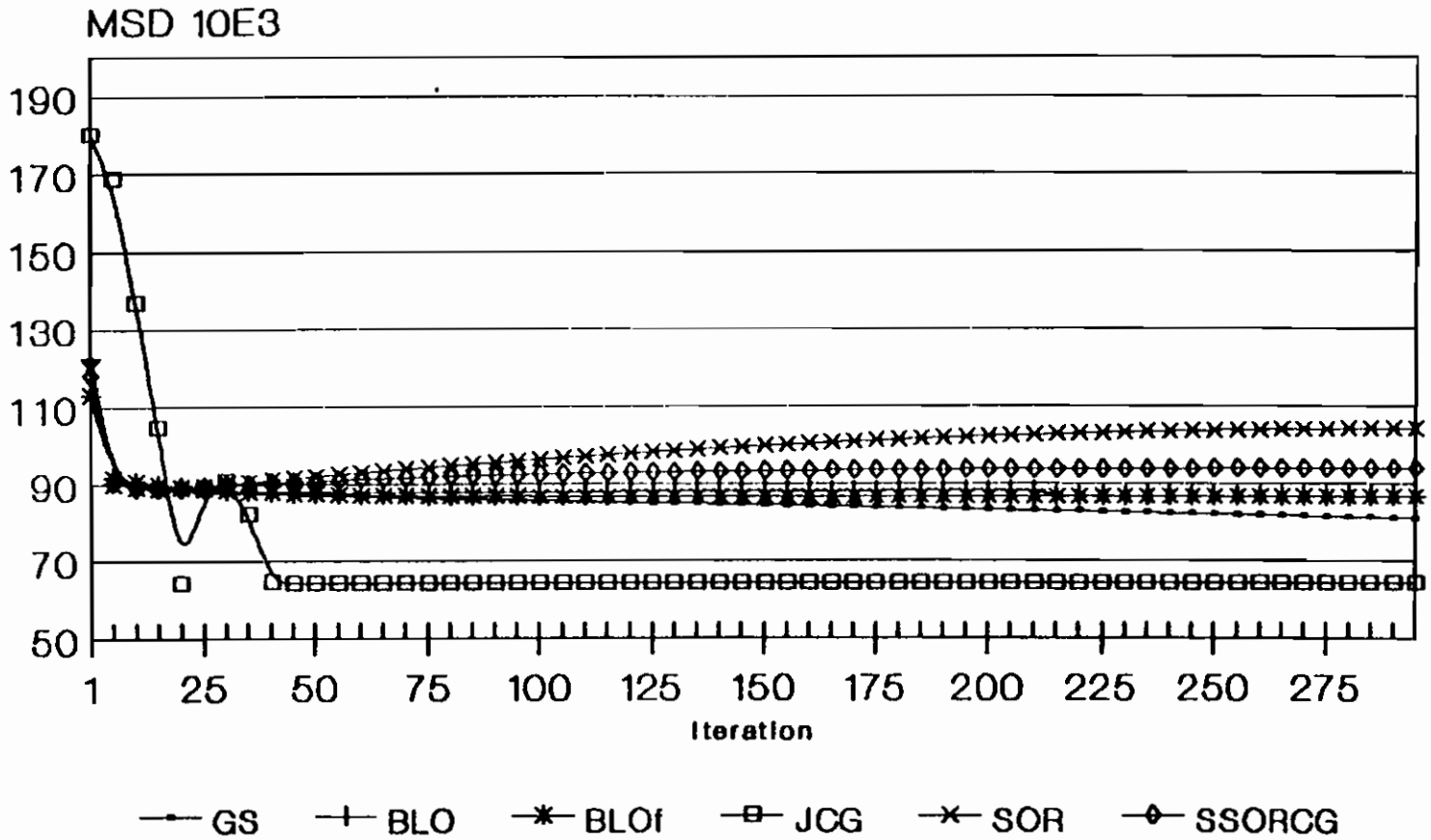
(size: 5000; selected pop'n)

Correlation between real and predicted breeding value for bulls during iteration



(size: 5000; selected pop'n)

Mean Squared Difference beteween real and predicted breeding value (MSD) for bulls during iteration



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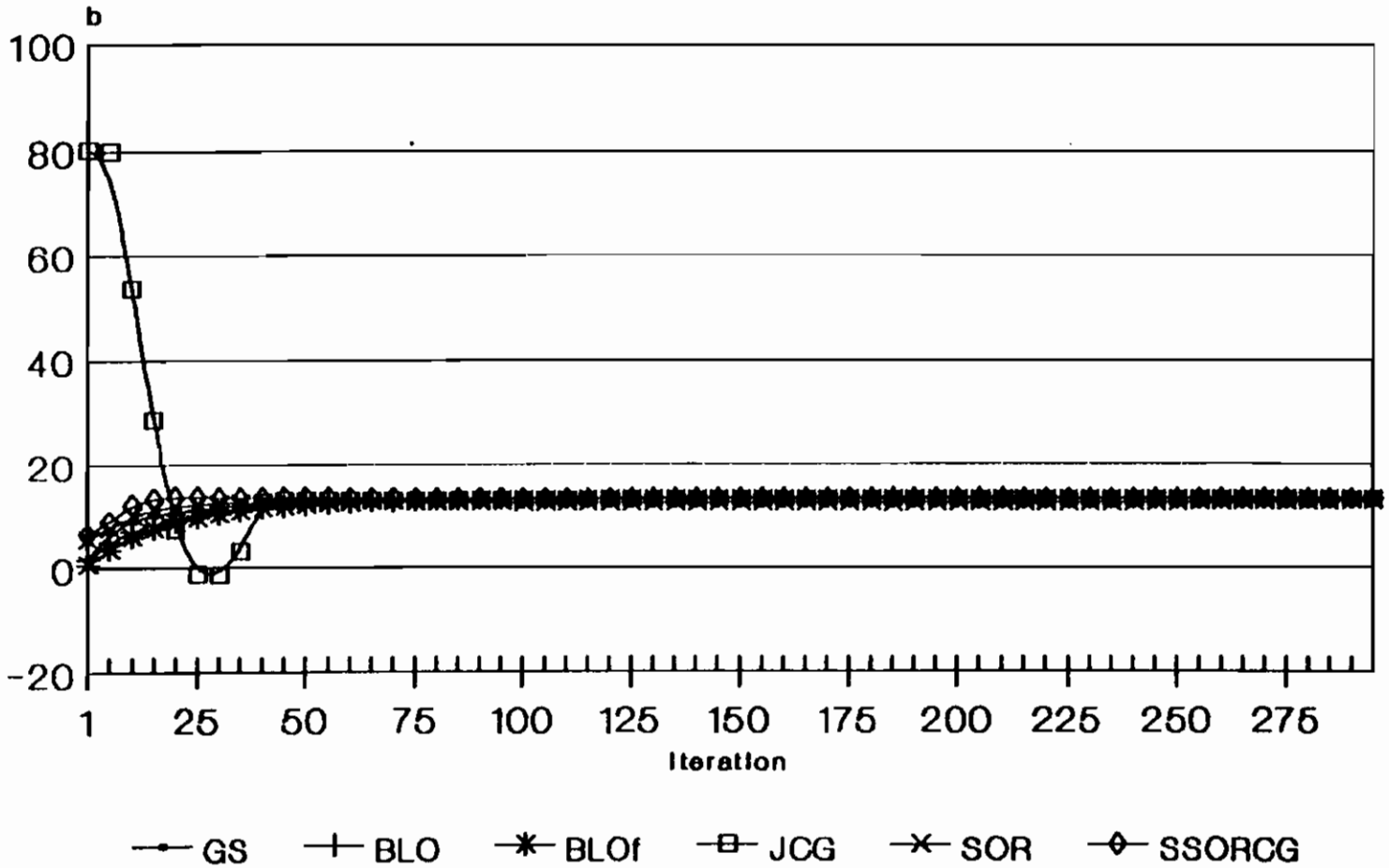
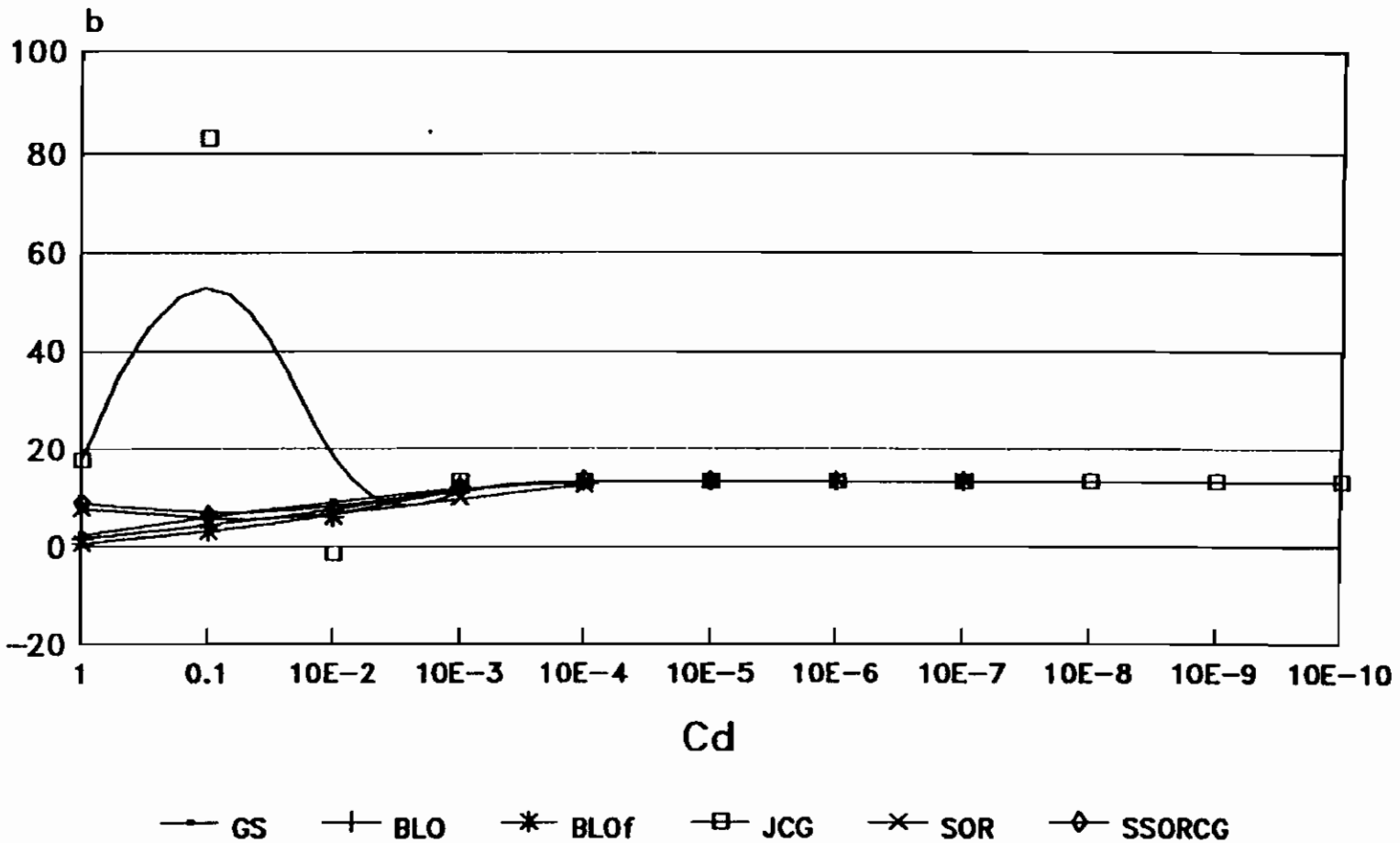
Estimated genetic trend (b) during iteration



(size: 5000; selected pop'n)

Estimated genetic trend (b)
when Cd changed one digit of accuracy



(size: 5000; selected pop'n)