Table 3. Estimated fertilizer replacement values (FRV) of legumes for forage sorghum; values based on cumulative seasonal sorghum yield. Legumes had been interseeded into chile pepper the previous year.

Legume	Fertilizer N replacement value (pounds/acre)	
	1994	1995
Madison hairy vetch	+[z]	+[z]
Parabinga barrel medic	24	22
Indianhead black lentil	10	14

[z]Forage sorghum dry-mass yields were higher following hairy vetch than the maximum estimated yield possible as a function of fertilizer N rate with the regression equations used.

FRV greater than 25 pounds of N per acre (Table 3). Clearly, hairy vetch was superior in terms of its capability to substitute for N fertilizer under the conditions of this study.

Conclusions

Fall growth of legumes interseeded into chile pepper could potentially be used as a winter cover crop. However, fall yield levels of the summer annuals barrel medic and black lentil appeared to be too low to add significant benefits to a second crop of forage sorghum. In contrast, hairy vetch managed as a winter annual significantly increased yield of a following forage sorghum crop compared to a nonfertilized control. Hairy vetch thus appears to have potential for relay intercropping into chile in similar environments. It can be established late enough in the season to not detract from chile yield (Guldan et al., 1996) yet early enough to over-winter and provide significant green-manure benefits to a following crop.

Literature cited

Abdul-Baki, A.A., J.R. Teasdale, R. Korcak, D.J. Chitwood, and R.N. Huettel. 1996. Fresh-market tomato production in a low-input alternative system using cover-crop mulch. HortScience 31:65–69.

Andrews, D.J. and A.H. Kassam. 1976. The importance of multiple cropping in increasing world food supplies, p. 1–10. In: R.I. Papendick, P.A. Sanchez, and G.B. Triplett (eds.). Multiple cropping. Amer. Soc. Agron., Madison, Wis. Spec. Publ. 27.

Blevins, R.L., J.H. Herbek, and W.W. Frye. 1990. Legume cover crops as a nitrogen source for no-till corn and grain sorghum. Agron. J. 82:769–772.

Decker, A.M., A.J. Clark, J.J. Meisinger, F.R. Mulford, and M.S. McIntosh. 1994. Legume cover crop contributions to no-tillage corn production. Agron. J. 86:126–135.

Diwan, N., G.R. Bauchan, and M.S. McIntosh. 1994. A core collection for the United States annual Medicago germplasm collection. Crop Sci. 34:279–285.

Duke, J.A. 1981. Handbook of legumes of world economic importance. Plenum Press, New York, NY.

Guldan, S.J., C.A. Martin, J. Cueto-Wong, and R.L. Steiner. 1996. Interseeding legumes into chile: Legume productivity and effect on chile yield. HortScience 31:1126–1128.

Hesterman, O.B. 1988. Exploiting forage legumes for nitrogen contribution in cropping systems, p. 155–166. In: W.L. Hargrove (ed.). Cropping strategies for efficient use of water and nitrogen. Proc. Symp. Amer. Soc. Agron., Crop Sci. Soc. Amer., Soil Sci. Soc. Amer., Atlanta, 30 Nov.–1 Dec. 1987.

Puckridge, D.W. and R.J. French. 1983. The annual legume pasture in cereal-ley farming systems of southern Australia: A review. Agr. Ecosystems Environ. 9:229–267.

SAS Institute. 1992. SAS user's guide. SAS Inst., Cary, N.C.

Schonbeck, M., S. Herbert, R. DeGregorio, F. Mangan, K. Guillard, E. Sideman, J. Herbst, and R. Jaye. 1993. Cover cropping systems for brassicas in the Northeastern United States: 1. Cover crop and vegetable yields, nutrients and soil conditions. J. Sustainable Agr. 3(3/4):105–132.

Slinkard, A.E., V.O. Biederbeck, L. Bailey, P. Olson, W. Rice, and L. Townley-Smith. 1987. Annual legumes as a fallow substitute in the northern Great Plains of Canada, p. 6–7. In: J.F. Power (ed.). The role of legumes in conservation tillage systems. Proc. Soil Conservation Soc. of Amer. Natl. Conf., Athens, Ga., 27–29 Apr. 1987.

Smith, M.S., W.W. Frye, and J.J. Varco. 1987. Legume winter cover crops. Adv. Soil Sci. 7:95–139.

Stute, J.K. and J.L. Posner. 1995. Legume cover crops as a nitrogen source for corn in an oat-corn rotation. J. Prod. Agr. 8:385–390.

Technicon Instruments Corporation. 1974. Ammoniacal nitrogen/BD acid digests. Industrial method no. 321-74A. Technicon Instruments Corp., Tarrytown, N.Y.

In-row Spacing Affects Machine-harvested Jalapeno Pepper

Carl E. Motsenbocker[1], Blair Buckley[2], William A. Mulkey[3], and James E. Boudreaux[4]

ADDITIONAL INDEX WORDS. ***Capsicum annuum*, mechanical fruit removal, yield, plant characteristics**

SUMMARY. **Field studies were conducted in 1991 and 1992 to evaluate the effect of in-row spacing on machine-harvested jalapeno pepper (*Capsicum annuum* L.) yield and plant characteristics. In 1991, 'TAM Mild Jalapeno-1' (TAMJ1) and 'Jalapeno-M' (JM) were planted at 4-, 8-, 12-, and 16-inch (10-, 20-, 30-, 40-cm) in-row spacings and, in 1992, TAMJ1 was planted at 3-, 6-, 9-, and 12-inch (7.5-, 15-, 22.5-, 30-cm) spacings. Total marketable yield increased linearly for JM (in 1991), while the yield response was quadratic for TAMJ1 in 1992 with narrower in-row spacing. Total marketable yield for JM (1991) and TAMJ1 (1992) was highest for the narrowest spacing, 4 and 3 inches, respectively. Red fruit yield of both cultivars in 1991 increased linearly with narrower spacing. In 1992 there were no differences in red fruit yield among in-row spacings. Plants lodged more at wider spacings. In-row spacings as narrow as 4 inches may increase marketable yield of machine-harvested jalapeno pepper.**

[1]Department of Horticulture.

[2]Calhoun Research Station.

[3]Sweet Potato Research Station. Current address: Dawson Farms, Inc., Delhi, LA.

[4]Louisiana Cooperative Extension Service.

Louisiana Agricultural Experiment Station manuscript no. 95-28-6354. We gratefully acknowledge the technical assistance of Tim Talbot and Alan W. Fennel. This research was supported in part by funding provided by the following Louisiana processing companies: Baumer Foods Inc., Bruce Foods Corp., Cajun Chef Products, Inc., Durkee-French Foods Inc., and the McIlhenny Co. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

In the United States, bell peppers (*Capsicum annuum*) comprise the majority of pepper production. The retail jalapeno market in the United States, however, has more than doubled from 1991 ($22 million) to May 1996 ($ 54 million) (Anonymous, 1996). Interest in fresh-market production of jalapeno pepper has increased as demand for pungent pepper types has expanded (Johnson and Johnson, 1992). Although there is increased interest in jalapeno production, information on optimal cultural practices for jalapeno peppers is minimal.

Management of production inputs and minimizing production costs is increasingly important. This is especially critical due to other production areas having increased access to U.S. markets as a result of bilateral agreements such as the North American Free Trade Agreement. Optimum in-row spacing studies have been conducted for a number of commercial pepper types, including simulated machine-harvested cayenne (Decoteau and Hatt-Graham, 1994), machine-harvested tabasco (Sundstrom et al., 1984), hand-harvested bell (Batal and Smittle, 1981; Everett and Subramanya, 1983; Locascio and Stall, 1994; Palevitch, 1969; Russo, 1991; Stoffella and Bryan, 1988), pimento (Johnson et al., 1973), and pepperoncini pepper (Motsenbocker, 1996). Although jalapeno is commercially important pepper, no research to our knowledge has been reported that evaluated in-row spacing for either hand- or machine-harvested jalapeno pepper. The purpose of this study was to evaluate the effect of in-row spacing on machine-harvested jalapeno pepper.

Materials and methods

Field studies were conducted in 1991 and 1992 at the Sweet Potato Research Station, Chase, La. The soil was a Gilbert silt loam (fine, silty, mixed, thermic, Typic Fragiudalfs).

FIELD STUDY 1991. Four in-row plant spacings (4, 8, 12, and 16 inches) were evaluated on raised beds 34 inches wide and 6 inches high. On 2 July 1991, plots were direct-seeded with 'TAM Mild Jalapeno-1 ' (TAMJ1) and 'Jalapeno-M' (JM) (Petoseed, Saticoy, Calif.) at a 1.5-inch spacing using a commercial precision drill seeder (model 870; Stanhay Webb Ltd., Sheffield, England). Individual plots consisted of three rows (40 inches between rows) with all data obtained from the middle rows. Plots were 35 feet long with a 5-foot alley between plots. Two weeks after seeding, plots were hand-thinned to the desired in-row plant spacing. Plots received preplant fertilizer (8N–10.4P–20K) 600 lb/acre banded in each row. At 4 and 8 weeks after seeding, the plots were sidedressed on the bed shoulder with N fertilizer ($NH4\ NO_3$; 50 lb N/acre). Plots were maintained weed-free throughout the growing season using preemergence (napropamide, 2.0 lb ai/ acre), lay-by (metolachlor, 1 lb ai/acre) and postemergence (sethoxydim, 0.25 lb ai/acre) herbicides and handweeding. Insect pests were controlled with two applications of acephate (0.5 lb ai/acre) and plots were sprinkler irrigated as needed throughout the season.

FIELD STUDY 1992. The in-row spacings evaluated in 1992 were reduced to 3, 6, 9, 12 inches due to the response to narrower spacing in 1991. On 8 July 1992, jalapeno (TAMJ1) pepper seeds were sown into 72-cell trays (2.25 length, 0.3 in^3) filled with commercial soilless media (Metromix 350; W.R. Grace & Co., Cambridge, Mass.) and placed in a greenhouse. The same day, guard rows (two) in field plots were direct-seeded with a precision seeder (as in 1991). At 4 weeks, the center row of each plot was hand-transplanted at one of the four desired in-row spacings. Plots received the same cultural practices as in 1991.

Plant characteristics were measured for three plants per record row before harvest both years. In 1991 the incidence of plant lodging (percentage of lodged plants) was determined and in 1992 canopy height and width was measured. A 5-foot subplot of each plot was hand-harvested, sized, and graded. Green fruit within the prescribed commercial processing requirements (>1 _ inch length) were designated marketable fruit. Fruit were sorted by grade; red, marketable green no. 1 (mature green, semi-smooth epidermal cracks, an indication of maturity), green no. 2 (mature green, no epidermal cracks), and undersize. Marketable fruit were counted and weighed.

Plots were then harvested in a once-over operation using a modified one-row commercial snapbean harvester (One-Row Pull-Pix; Pixall Corporation, Clear Lake, Wis.) on 23 Oct. 1991 and 26 Oct. 1992. The plots both years were harvested 16 weeks after planting. All plots had red fruit at harvest to determine the effect of in-row plant spacing on fruit maturity. The Pull-Pix has been used successfully in South Carolina to harvest cayenne pepper for processing (T.J. Garrett, personal communication). In 1991, the harvester was modified; every other bar with picking fingers on the picking reel was removed (5 of 10) as well as the first row of fingers on both ends of the picking reel (perpen-

Table 1. Effect of in-row spacing on 'TAM Mild-1' jalapeno pepper yield and plant lodging, 1991.

In-row spacing (inches)	Yield						Plant lodging	Trash	Mechanical damage
	Total[z] (cwt/acre)	Total[z] (%)	Green no. 1[y]	Green no. 2[x]	Red	Undersize			
			(cwt/acre)				(%)		
4	66.9	53	12.6	54.3	14.6	7.6	13	7	14
8	66.2	44	8.2	58.0	8.3	7.0	27	6	12
12	73.7	52	18.3	55.4	7.5	6.7	46	5	14
16	45.3	73	5.3	40.0	1.9	5.4	67	5	10
Significance	NS	L*	NS	NS	L***	NS	L***	NS	NS

[z]Total yield equals green no. 1 and green no. 2 combined expressed as cwt/acre and as a percentage of the hand- harvested check, respectively.
[y]Green no. 1 equals green fruit of marketable size with epidermal growth cracks.
[x]Green no. 2 equals marketable size green fruit without growth cracks.
NS,*,***Nonsignificant or significant at $P < 0.05$ or 0.001, respectively; L = linear.

dicular to the reel). In 1992 the mechanical harvester was modified further by replacing metal picking fingers with rubber-coated metal fingers (1.5 cm in diameter) acquired from the manufacturer. Total yield of machine-harvested plots was measured and a subsample of each plot (8.9 L) was sorted and graded as described previously. Pepper fruit yield, trash, and fruit damage from mechanical removal were recorded. Plots were established in a randomized complete-block design, with three and four replications in 1991 and 1992, respectively. Data were subjected to an analysis of variance and orthogonal contrasts were used to identify significant trends. Because of significant cultivar by spacing interactions in 1991, the data for the two cultivars are presented separately. In addition, plant lodging data were subjected to arcsine transformation before analysis.

Results

FIELD STUDY 1991. In-row spacing did not significantly affect TAMJ1 total marketable yield (Table 1). Yield ranged from 45.3 cwt per acre for the 16-inch spacing to 73.7 cwt per acre for the 12-inch spacing. The efficiency of machine-harvest (mechanical fruit removal as a percentage of the hand-harvest) ranged from 44 to 73% and increased linearly with wider spacing. Green no. 1 and green no. 2 yield did not vary due to in-row spacing. Red grade fruit yield (an indication of maturity), however, was affected by in-row spacing. As in-row spacing increased from 4 to 16 inches, red fruit decreased linearly. Undersize fruit yield was unaffected by spacing. Wider spacings resulted in a linear increase in plant lodging. Damage from mechanical fruit removal and trash percentage were unaffected by in-row spacing. Mechanical damage ranged from 10% to 14% and trash from 5% to 7%. Marketable fruit average weight did not vary due to in-row spacing either year (data not reported).

Increasing in-row spacing from 4 to 16 inches resulted in linearly decreased total JM yield (Table 2). Yield ranged from 23.0 cwt per acre for the 16-inch spacing to 51.3 cwt per acre at the narrowest spacing. The efficiency of harvest (machine-harvest/hand-harvest yield) was unaffected by in-row spacing and ranged from 71% to 86%. As in-row spacing decreased, green #1 yield decreased linearly while green no. 2 yield was unaffected by in-row spacing. Red fruit yield decreased linearly with wider plant spacing while the undersize grade yield was unaffected. Wider spacing resulted in a linear increase in plant lodging. In-row spacing did not statistically affect mechanical damage and trash percentage. Mechanical damage ranged from 9% to 12% and trash 3% to 12% among in-row spacings.

FIELD STUDY 1992. As in-row spacing increased from 3 to 12 inches, total and green no. 1 responded cubically while there was a linear decrease in green no. 2 yield (Table 3). The highest total, green no. 1, and green no. 2 yield resulted from the narrowest spacing (3 inches). Mechanical harvest efficiency ranged from 76% to 83% among in-row spacings. Red grade yield was not significantly affected by in-row spacings. Red grade yield was not significantly affected by in-row spacing, while undersize yield increased linearly with narrower in-row spacing. Mechanical damage was unaffected by in-row spacing and ranged 4% to 5% while trash ranged from 1% to 2%. Narrower in-row spacing resulted in a linear increase in canopy height with no effect on canopy width.

Discussion

Fruit yield characteristics: Total yield responded cubically 1 out of 2 years for TAMJ1 and linearly for JM jalapeno pepper to narrower in-row spacing. Where there was a response to in-row spacing, the highest yields were obtained at the narrowest spacing. The total yield of the narrowest spacing (4 inches) was 147% and 223% of the widest spacing (16 inches) for TAMJ1 and JM, respectively in 1991 and 124% for TAMJ1 total yield of the narrowest (3 inches) to widest spacing (12 inches) in 1992. The results of this study are similar to those reported for other pepper types (Decoteau and Hatt-Graham, 1994; Motsenbocker, 1996; Palevitch, 1969; Stoffella and Bryan, 1988; Sundstrom et al, 1984). For hand-harvested pepperoncini pepper, narrower spacings resulted in a linear increase in early and total yield (Motsenbocker, 1996). The yield increase was reportedly due to increased fruit yield per acre resulting from higher plant population while fruit numbers per plant were lower. Narrowing in-row spacing from 60 to 15 cm (24 to 5 inches) of simulated-machine harvested cayenne, resulted in a quadratic response for red yield and a linear increase in green and total (green and red) pepper fruit yield (Decoteau and Hatt-Graham, 1994). On a per-plant basis, red, green, and total cayenne yield per plant increased linearly with wider row spacing. For machine-harvested tabasco pepper, as in-row spacing decreased from 40 to 19 cm (16 to 8 inches), total red pepper yield increased linearly at one location and resulted in a cubic response at the second location (Sundstrom et al.,

Table 2. Effect of in-row plant spacing on yield and plant lodging of 'Jalapeno-M' jalapeno pepper, 1991.

In-row spacing (inches)	Yield: Total[z] (cwt/acre)	Total[z] (%)	Green no. 1[y] (cwt/acre)	Green no. 2[x] (cwt/acre)	Red (cwt/acre)	Undersize (cwt/acre)	Plant lodging (%)	Mechanical damage (%)	Trash (%)
4	51.3	86	12.1	39.0	12.8	27.2	9	5	12
8	28.4	86	5.7	22.7	6.7	19.6	42	3	10
12	28.5	81	7.1	21.4	4.7	25.7	61	4	9
16	23.0	71	3.4	19.6	2.9	14.0	51	12	9
Significance	L*	NS	L*	NS	L**	NS	L*	NS	NS

[z]Total yield equals green no. 1 and green no. 2 combined expressed as cwt/acre and as a percentage of the hand- harvested check, respectively.
[y]Green no. 1 equals green fruit of marketable size with epidermal growth cracks.
[x]Green no. 2 equals marketable size green fruit without growth cracks.
NS,*,**Nonsignificant or significant at $P < 0.05$ or 0.01, respectively; L = linear.

1984). Increasing in-row spacing from 13 to 51 cm (5 to 20 inches) resulted in linearly decreased bell pepper yield per acre while fruit number and yield per plant increased linearly (Stofella and Bryan, 1988) and red bell pepper yields were highest for the narrowest (20 cm, 8 inches) in-row plant spacing (Palevitch, 1969). In another study, bell pepper yield was highest at 28 cm (11 inches) in-row spacing (40,000 plants/ha) compared to a 41 cm (16 inches) spacing (27,000 plants/ha) for a two rows per bed configuration (Batal and Smittle, 1981). But, yields were not affected by these two in-row spacings in a pattern of 3 rows per bed which gave 60,000 and 40,000 plants/ha, respectively.

Red fruit yield was highest at the narrowest row spacing 1 out of 2 years for TAMJ1 and for JM in 1992, indicating enhanced earliness with narrower spacing. Similar results have been reported for other pepper types (Palovitch, 1969; Sundstrom et al., 1984). Red tabasco pepper percentage responded quadratically to wider row spacing with the highest red fruit percentage resulting from a 20-cm (8 inches) spacing (Sundstrom et al., 1984), and the narrowest spacing (20 cm, 8 inch) resulted in more mature bell pepper as determined by color ratings (Palevitch, 1969).

Vegetative characteristics. In 1991, narrower in-row spacing (higher plant population/acre) resulted in less plant lodging for both cultivars. This characteristic may be important for both hand and mechanical fruit removal as harvest ease may be greater with plants that are more upright. Similar results have been reported with pepperoncini (Motsenbocker, 1996) and tabasco pepper (Sundstrom et al., 1984). It has been postulated that plants at a narrower in-row spacing may use adjoining plants for support (Sundsrom et al., 1984). In our study, plants spaced closer together had taller plant canopies with no effect on width (1992). For hand removal, taller plants with fruit higher in the canopy may be easier to locate for harvest. Research with cayenne indicates that in general, with higher population densities, fruit was located more in the upper canopy (Decoteau and Hatt-Graham, 1994). For mechanical fruit removal, depending on the mechanical harvester, plant height may be a constraint in harvest as taller plant canopies may be unable to fit into the harvester opening.

In 1991, the combined mechanical damage and trash percentage was greater than the processing industry acceptable 5%. After further modification to the harvester in 1992, however, combined trash and mechanical damage ranged 5% to 7%. Further experimentation with the harvester may bring this level down so that it would be acceptable to processors. Another option would be to remove some of the trash in the field or at a grading facility after harvest. In addition, although the plants were harvested 16 weeks after planting both years, the percentage red fruit in 1992 was less.

In conclusion, the results of this study indicate that in-row plant spacing affects jalapeno pepper plant characteristics and fruit yield. The current in-row spacing recommendation for commercial jalapeno production in Louisiana is 12 to 18 inches (Boudreaux, 1996). The data from this study (2 of the 3 crops) indicates that growers may increase yields by reducing in-row spacing to as narrow as 3 inches. In addition, the use of a cultivar such as TAM Mild Jalapeno-1, that is a fairly compact plant with highly concentrated fruit set of uniformly mature fruits, may also be important to increase marketable yields. Further research is needed to investigate the interaction of cultivar on in-row spacing and fertility as well as the affect of these factors on yield characteristics and mechanical fruit removal.

Literature cited

Anonymous. 1996. Information Resources, Inc. Chicago.

Batal, K.M. and D.A. Smittle. 1981. Response of bell pepper to irrigation, nitrogen, and plant population. J. Amer. Soc. Hort. Sci. 106:259–262

Boudreaux, J.E. 1996. Commercial vegetable production recommendation. Louisiana Coop. Ext. Serv. Publ. 2433

Decoteau, D.R. and H.A. Hatt-Graham. 1994. Plant spatial arrangement affects growth, yield, and pod distribution of cayenne peppers. HortScience 29:149–151

Everett, P.H. and R. Subramanya. 1983. Pepper production as influenced by plant spacing and nitrogen-potassium rates. Proc. Fla. State Hort. Soc. 96:79–82

Johnson, J.R. and C.D. Johnson. 1992. Two zesty alternatives to bell peppers. Amer. Veg. Grower 40(5):25-27

Johnson, W.W., C.E. Evans, H.M. Hollingsworth, and E.L. Mayton. 1973. Production practices for pimento pepper-fertilization rates, plant spacings, and varietal strains. Auburn Univ. Agr. Expt. Sta. Bul. 444

Locascio, S.J. and W.M. Stall. 1994. Bell pepper yield as influenced by plant spacing and row arrangement. J. Amer. Soc. Hort. Sci. 119:899–902

Motsenbocker, C.E. 1996. In-row plant spacing affects the growth and yield of pepperoncini pepper. HortScience 31:198–200

Palevitch, D. 1969. Varietal and spacing effects on the yield of red pepper (*Capsicum annuum* L.) in single harvest. Israel J. Agr. Res. 19:65-69

Russo, V.M. 1991. Effects of fertilizer rate, application timing, and plant spacing on yield and nutrient content of bell pepper. J. Plant Nutr. 14:1047–1056

Stoffella, P.J. and H.H. Bryan. 1988. Plant population influences growth and yields of bell pepper. J. Amer. Soc. Hort. Sci. 113:835–839

Sundstrom, F.J., C.H. Thomas, R.L. Edwards, and G.R. Baskin. 1984. Influence of N and plant spacing on mechanically harvested tabasco pepper. J. Amer. Soc. Hort. Sci. 109:642–645.

Table 3. Effect of in-row plant spacing on yield and plant characteristics of 'TAM Mild Jalapeno-1' pepper, 1992.

In-row spacing (inches)	Yield: Total[z] (cwt/acre)	Yield: Total[z] (%)	Yield: Green no. 1[y] (cwt/acre)	Yield: Green no. 2[x] (cwt/acre)	Yield: Red (cwt/acre)	Undersize	Mechanical damage (%)	Trash (%)	Canopy width (inches)	Canopy ht (inches)
3	50.6	78	30.2	20.4	1.6	16.1	5	2	18.9	20.2
6	40.5	76	23.8	16.7	1.2	12.6	4	1	19.3	19.1
9	45.4	83	27.9	17.5	1.8	12.4	5	2	20.1	18.9
12	40.8	78	25.6	15.2	0.9	12.1	4	2	18.5	17.9
Significance	L*C*	NS	C*	L*	NS	L*	NS	L*Q**	NS	L***

[z]Total yield equals green no. 1 and green no. 2 combined expressed as cwt/acre and as a percentage of the hand- harvested check, respectively.
[y]Green no. 1 equals green fruit of marketable size with epidermal growth cracks.
[x]Green no. 2 equals marketable size green fruit without growth cracks.
NS,*,**,***Nonsignificant or significant at $P < 0.05$, 0.01, or 0.001, respectively; L = linear, Q = quadratic, and C = cubic.