

Sangiovese at FPS

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SANGIOVESE HAS BEEN CULTIVATED in Italy for well over a thousand years, and is presently the most widely planted grape cultivar there, covering some 235,000 acres or approximately 10% of total vineyard acreage. Although considered indigenous to Tuscany, Sangiovese is grown throughout Italy, indicating its adaptability to different environmental conditions. This adaptability has, over the centuries, given rise to significant variability in the properties of the vine and the fruit so that now many Italian viticulturists regard Sangiovese as a population rather than a cultivar (single genotype).

Development of a nomenclature for Sangiovese is in fact a “work in progress”. For well over a century Sangiovese has been referred to by a plethora of names, synonyms, clones and, more recently, biotypes (Molon, 1906; Calo, et. al., 2001; Calo, Costacurta, et. al., 2004; Giavedoni and Gily, 2005). These names and synonyms include Sangiovese grosso, Sangiovese piccolo, Sangiovetto, Sangiogheto, San Giovetto, San Zoveto, Prugnolo, Morellino, Brunello, and Nielluccio among numerous others.

For well over a hundred years Italian growers have recognized two main types of Sangiovese, grosso and piccolo, based upon perceived differences in cluster size and shape, berry size and weight, morphology of leaves, etc. (Molon, 1906; Boselli, 2001; Calo et. al., 2001). Although some viticulturists believe that a clear distinction between Sangiovese grosso and piccolo does not now exist, others believe that a distinction between the two types can be made (Boselli, 2006). However, due to evolving diversity the terms “grosso” and “piccolo” may not always correspond well with vines of larger or smaller berries and clusters. Related to this is the report of Silvestroni and Intrieri (1995) who suggested fruit size differences observed in the past might have been due to unknown virus infections. If so, more consistent sizes would be expected after removing virus from propagation stock.

More recently, Italian researchers have organized Sangiovese by grouping similar vines into biotypes for which distinct morphological and technical differences can be observed in the grape/vine. For example, Boselli (2006) considers Brunellino, Brunelletto, and Prugnolo gentile to be biotypes of Sangiovese. Calo et. al., (1995) described six Sangiovese biotypes based on fruit, cluster, leaf, ripen-

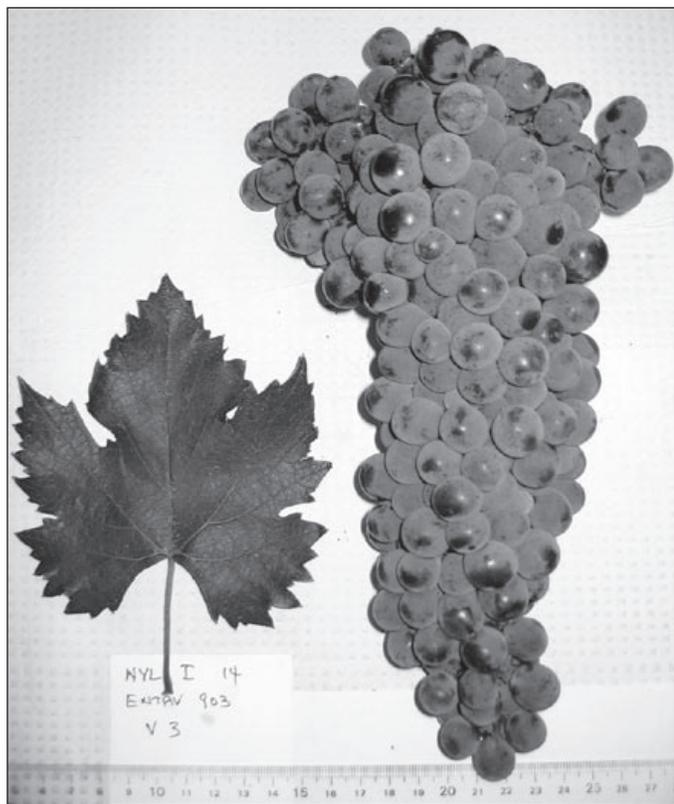
ing and must characteristics--two from central Tuscany, one from the Tuscan coast near Pisa (Peccioli di Pisa), one from the Emilia-Romagna region near Predappio (Romagnolo), one cultivated along the Adriatic sea coast (Marchigiano), and one from Corsica (Nielluccio). In addition, a recent paper reports on 14 biotypes of Sangiovese grown in the University of Florence vineyards (Pisani, Boselli, et. al., 2004)

It is anticipated that, in the future, synonyms and biotypes will slowly be replaced by certified clone designations. At present there are over 70 approved clones of Sangiovese in Italy. Most clones have been developed by the universities of Bologna, Firenze-Pisa, Bari, Milano, Milano Banfi srl, and Tuscany, as well as the private nurseries such as Vivai Cooperativi Rauscedo (VCR). In addition, as a result of the extensive research completed during the Chianti Classico 2000 project and the corresponding Brunello di Montalcino project, a number of new certified clones of Sangiovese have been approved (Boselli, et. al., 2004; Mattii, 2006(a)). In the following paragraphs, biotype names have been included in the descriptions of various FPS selections since all available information about source materials could be useful.

At FPS¹ grapes are identified by a variety name and an FPS selection number that corresponds to an original single vine source. Information about the source of vines, such as European clone number and country of origin, is linked to the selection number in the FPS public record. Different FPS selection numbers are also assigned when treatments are used to eliminate known or suspected virus disease. Each treated plant becomes a new single vine source and is assigned a unique FPS selection number. For example, Sangiovese FPS 06 and FPS 20 were both derived from the same single vine source (Italian clone FI-PI-4), but they are considered different selections at FPS because FPS 06 was propagated from the original material without any treatment, whereas microshoot tip culture was used to create FPS 20. Since virus elimination treatments do not usually affect the genotype of a plant, FPS 06 is likely to be genetically identical to FPS 20 even though the two selections have a different health status (FPS 20 tested negative and FPS 06 tested positive for Rupestris stem pitting (RSP)).

¹ In the interest of simplicity, “FPS” is used in this article to identify both grape selections in the current Foundation Plant Services (FPS) grape collection and older selections that were included in the collection when the program was called Foundation Plant Materials Service (FPMS). The name changed from FPMS to FPS in 2003.

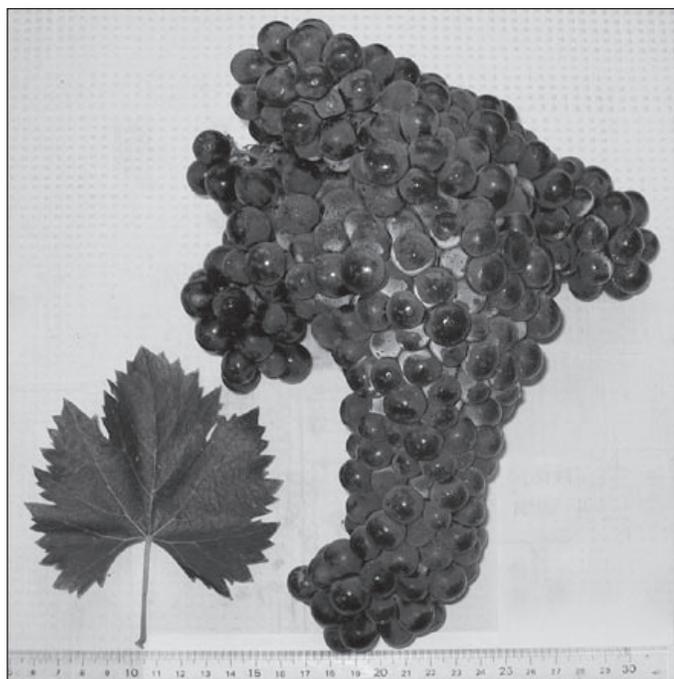
Sangiovese selections available from Foundation Plant Services



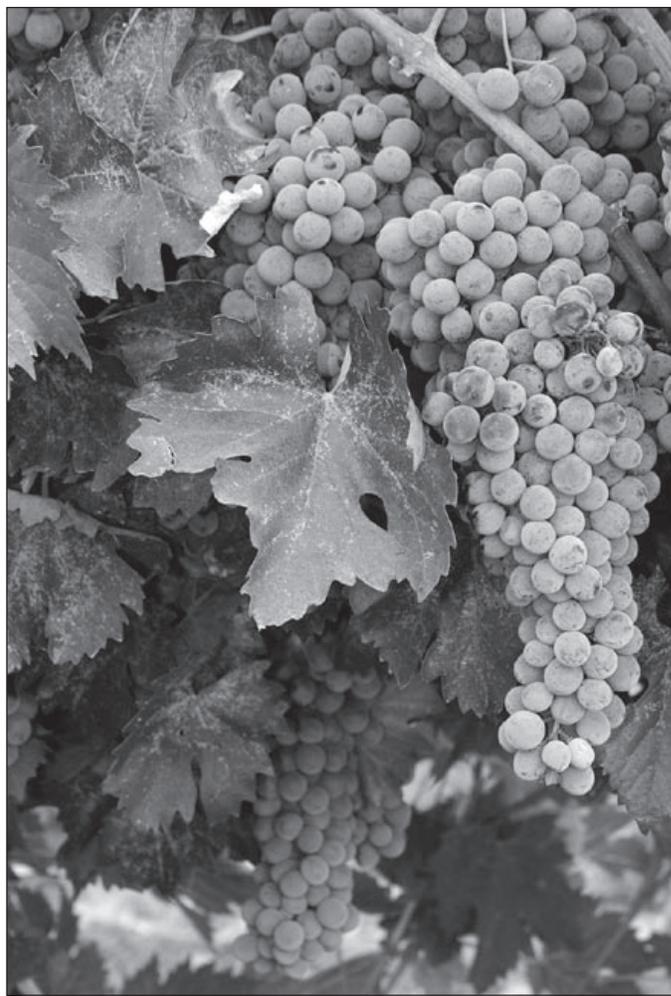
Nielluccio ENTAV-INRA® 903
photo by JaRue Manning



Sangiovese FPS 20 in the Foundation Vineyard
photo by Bev Ferguson



Sangiovese FPS 08
photo by JaRue Manning



Sangiovese FPS 05 from the "Bionde Santi" clone
photo by Bev Ferguson

Although we know some FPS selections are probably genetically identical to one another, in most cases we do not know which selections are genetically unique clones. Replicated vineyard trials are currently the only way to determine whether selections have phenotypic differences that justify identifying them as unique clones. Some trials of this sort have been conducted by private and public researchers, but horticultural evaluations have never been part of the prescribed process to qualify grape selections for any of the certification programs in the U.S. Since horticultural evaluations are a major component in the French and Italian grape certification programs, they refer to their material as “clones.” European clones, however, do not always perform the same in California as they do in Europe, so horticultural information from European clonal trials may not be applicable to U.S. conditions.

Someday DNA methods currently used to identify grape varieties may become sophisticated enough to routinely distinguish between clones, but the technology is not yet that advanced. Traditional ampelography (visual inspection) does not seem to be a reliable method for identifying specific clones/selections either. Consequently, the only way to know a vine’s clonal/selection identity is to review the records for propagation wood sources.

The oldest Sangiovese selection in the FPS collection was imported from Italy in 1940 by the late Dr. Harold Olmo, professor, UC Davis Department of Viticulture and Enology. According to Darrell Corti, “... Olmo asked Enrico Prati, then working for the Italian Swiss Colony, and who was returning to Italy on a visit, to bring back with him some Sangiovese cuttings. Much to Olmo’s astonishment, Prati returned with two bundles, each with two rooted vines in them.” The selection was planted on the UC Davis campus in a location described as J74 V13. In 1965 USDA-ARS Plant Pathologist Dr. Austin Goheen worked to qualify this selection of Sangiovese for the California Grapevine Registration and Certification (R&C) program. He must have suspected a virus infection because he used heat treatment to clean it up before conducting any disease tests. Two selections from the original material survived heat treatment and became Sangiovese FPS 01 (heat treated 81 days) and FPS 02 (heat treated 145 days).

Sangiovese FPS 01 was included in the R&C program until about 1970, during the period when Mission was used as the field indicator for leafroll. It was removed in 1985 when it tested positive for leafroll on the field indicator Cabernet Franc, which became the new standard for field leafroll tests in the 1980s.

Sangiovese FPS 02 was added to the R&C program in 1977. FPS 02 tested negative for leafroll when it was rechecked in 1984 on Cabernet Franc and still remains registered in the R&C program today. The longer heat treatment used to create FPS 02 may be the reason it has always tested negative for virus.

Sangiovese FPS 03/FPS 24: In 1973 Goheen imported a selection of Sangiovese that was assigned plant introduction number (PI) 391453. According to the USDA-ARS Plant Inventory, this selection came from F. Scaramuzzi, Direttore dell’Istituto di Coltivazioni Aboree, Università di Firenze, Firenze, Italy. However, Goheen’s records show that the source was Pavia, Italy, which is more than 180 miles northwest of Firenze. The import dates match between the two records, but there is nothing to explain the source disparity. This selection initially tested negative for virus without any heat treatment and was registered in the R&C program for the first time in 1980 as Sangiovese FPS 03. It was dropped from registration in the early 1990s when ELISA tests showed FPS 03 had become infected with leafroll, which was spreading in the old foundation block. A selection designated Sangiovese FPS 24 was recently produced from FPS 03 using microshoot tip tissue culture. FPS 24 tested negative for leafroll and was planted in the current foundation block in 2005. Customers may now order Provisional status mist propagated plants of FPS 24 from FPS.

UC Davis Department of Viticulture and Enology Viticulture Specialist Emeritus Dr. Pete Christensen (1999) reported that FPS 02, 03 and 04 showed distinct clonal differences in a San Joaquin Valley trial. He also said that FPS 02 may be preferred over FPS 03 because it has smaller berries and higher vine fruitfulness and yield. However FPS 02 may require more cluster thinning than FPS 03 to achieve vine balance.

Sangiovese FPS 04: Goheen arranged to import a public selection of Sangiovese from Vivai Cooperativi Rauscedo (VCR) in Italy in 1983. VCR is a private nursery cooperative that was formed 70 years ago and which currently has an annual production capacity of over 45 million vines. More than 30 years ago, VCR started its own clonal selection program which includes microvinification for evaluating winegrape clones. The clone VCR sent to Goheen in 1983 was designated “Rauscedo 10 (Grosso Lamole).” The original material tested negative for virus so it was registered in about 1992. However it was placed on “hold” in 1999 because Christensen (1999) reported that in a San Joaquin Valley clonal trial “Clone 4 [FPS 04] was generally undesirable as compared to the others [FPS 02 & 03]. It had the poorest fruit composition, with significantly lower titratable acidity and higher pH,

and the greatest incidence of bunch rot. It was also lowest yielding.” Selections on “hold” at FPS are still in the foundation block and remain registered in the R&C program, but customers are informed about the problems that triggered the “hold” status before they purchase the materials. In the case, growers may find areas outside of the San Joaquin Valley where Sangiovese FPS 04 would perform well.

In 1995 Alberto Antonini sent FPS three Sangiovese clones from Italy for the Robert Mondavi Winery. These clones (FI-PI-4, FI-PI-172, and B-BS-11) were selected at the University of Florence and Pisa. Upon release from quarantine, propagation materials were provided exclusively to Mondavi. After two years the winery generously allowed FPS to change the status of all three clones to “public” so they could be distributed without restriction. Special thanks to Rupert Mathieu for his help with the translation of the three following Sangiovese clone descriptions that appeared in the Italian trade journal *Vignevini*, December 12, 1994—the descriptions are included below with their associated FPS selection numbers.

Sangiovese FPS 06 and FPS 20 were both derived from the same 1995 introduction of FI-PI-4. The original material tested positive for RSP, but since RSP is not one of the diseases prohibited by U.S. federal or California state quarantine regulations, it was released from quarantine in 1999 without any treatment. RSP was dropped from the California Grapevine Registration and Certification (R&C) program requirements on January 1, 2001, so the original material was registered in 2001 and designated Sangiovese FPS 06. Another selection, created from the original FI-PI-4 material using microshoot tip tissue culture, tested negative for RSP. It is designated Sangiovese FPS 20 in the FPS collection and was registered in the R&C program in 2005. The Sangiovese FI-PI-4 clone is a Grosso Montalcino biotype. The vine has medium vigor and good fertility. The clusters are small and loose with a pyramidal shape and one wing. The berries are small with an oblate shape, blue-violet color, and have good tolerance to botrytis. The wine is deep red with a vinous aroma. It is spicy, alcoholic when young and suitable for quality wine with a moderate period of aging.

Sangiovese FPS 19: The original FI-PA-172 material imported in 1995 tested positive for RSP and Grapevine fleck virus, which is of quarantine concern. Tissue culture was used to eliminate fleck and RSP and create a selection designated Sangiovese FPS 19. FPS 19 was released from quarantine in 2003 and registered in the R&C program in 2005. The FI-PA-172 clone is a Grosso Lamole biotype with good vigor, medium-high produc-

tivity, moderate fertility and top quality. The clusters are extended with one wing, small, fairly compact, and pyramidal. The berries are medium, blue-violet, ovoid, and tolerant of botrytis. The wine is intense ruby red with a vinous aroma, alcoholic, sapid with a full body, suitable for wines destined for moderate to long aging.

Sangiovese FPS 12: The original B-BS-11 material imported in 1995 was infected with leafroll, fleck, and RSP. Sangiovese FPS 12 was created from the original material using tissue culture, which successfully eliminated the viruses. FPS 12 was released from quarantine in 2001 and registered in the R&C program in 2003. The original B-BS-11 clone is a Grosso Montalcino biotype that is reported to have good vigor, moderate and consistent production, above average fertility. The clusters are small, extended compact with one wing. Berries are of medium consistent size, ovoid with a uniform blue color with good botrytis tolerance. The wine is ruby red, with a vinous aroma, delicate, alcoholic, sapid and with sustained acidity and reasonable body, suitable for aging.

In 1996 six Sangiovese clones (and one likely to be a Sagrantino clone) were collected for FPS from the Robert Pepi Winery in Oakville, California, thanks to the efforts of Greg La Follette and the generosity of Kendall-Jackson Vineyards and Winery, owners of the Pepi Winery at the time. La Follette invited Dr. Anna Schneider, ampelographer from the Centro di Studi per il Miglioramento Genetico della Vite, CNR, Torino, Italy to visit in May 1996. She inspected a collection of Sangiovese clones assembled by Robert Pepi and planted in a clonal trial next to the Pepi Winery. She also selected ‘true to variety’ source vines for each of the clones for the FPS collection.

Assorted viruses (leafroll, fanleaf and/or RSP) were detected at FPS in all seven of the selections from the Pepi vineyard. Microshoot tip tissue culture was used to eliminate the virus and create selections qualified for foundation stock status for all seven of the original clones. The virus-tested selections are now identified with FPS selection numbers shown below along with their original Pepi clone designations and a few horticultural observations made by Greg La Follette.

Sangiovese FPS 05 and FPS 14 were made from the Pepi vineyard “Bionde Santi” clone of Sangiovese Grosso (Brunello). Robert L. Pepi (2006) said, in a recent personal email, “We were told back in 1983, by the nurseryman in Italy who procured the cuttings for us, that indeed the clone we received was the Bionde Santi clone.” Bionde Santi is the clone used in Brunelle di Montalcino to make a wine called Brunello. La Follette said this clone has lower vigor than the other six in the Pepi Winery trial. FPS 05 was obtained from the original

Pepi Bionde Santi material without any virus elimination treatment since it tested positive only for RSP. FPS 05 was registered in 2001. Tissue culture was used to make FPS 14 from FPS 05. FPS 14 tests negative for RSP and was registered in 2003.

Sangiovese FPS 15: The “Atlas Peak” or “Dr. Peterson” clone was selected for the Pepi Winery by Dick Peterson from the Atlas Peak Antinori selection. La Follette says that it flowers very early and has large clusters with big wings and long rachii. The petiolar sinus is very large. Sangiovese FPS 15 was made from this source using microshoot tip tissue culture and registered in 2003.

Sangiovese FPS 22: During her 1996 vineyard inspection, Schnieder reported that the Pepi vineyard “Crown clone” vines were not Sangiovese. She thought they could be Sagrantino, although a positive identification could not be made. Pepi reported that the Italian nurseryman who provided the cuttings said that a few of the cuttings were Sagrantino. DNA tests on Sangiovese FPS 22, derived from the Crown clone, do not match Sangiovese or any other cultivar in the FPS DNA profile database. FPS 22 is currently on “hold” until the vines can be professionally identified either by an expert who can recognize the variety or through a DNA match.

Sangiovese FPS 23: Sangiovese FPS 23 was derived from the Pepi “Bob Jr.” clone and planted in the FPS foundation block in 2005. Pepi said he does not know this clone, so the origin of the name is unclear. La Follette reported that this clone flowers late and is extremely fertile with many small size clusters. FPS 23 will have Provisional registration status until it fruits and is professionally identified.

Sangiovese FPS 17: One Pepi clone was labeled “Oakville Station,” possibly indicating that the clone was derived from material at the UC Davis Department of Viticulture and Enology Oakville field station. However we could find no record of Sangiovese being planted at the field station, so the source is uncertain. La Follette reported that this clone had the lowest yield of the trial, generally had just one wing per cluster (other clones often have two), produced small bunches and had low vegetative vigor. Sangiovese FPS 17 was derived from this selection which was registered in the R&C program in 2003.

Sangiovese FPS 26: La Follette notes that the “Alexander Valley Estancia” clone at Pepi is “very distinctive.” It has closed petiolar sinus, very small clusters and very weak habit showing some Eutypa. At FPS it tested positive for leafroll, fanleaf and RSP. Sangiovese FPS 26 was derived from this clone using microshoot tip tissue cul-

ture and planted in the foundation block in 2006. It will have Provisional registration status until it is professionally identified.

Sangiovese FPS 21: The “Rutherford/Saint Helena” or “Rutherford Franciscan” clone from the Pepi vineyard has very vigorous vegetation and large clusters, but not as large as the Atlas Peak/Dr. Peterson clone according to La Follette. It tested positive for leafroll, fanleaf and RSP at FPS. Sangiovese FPS 21, which was derived from this clone, was registered in 2004.

Nielluccio ENTAV INRA ® 903: In 1997 the ‘Etablissement National Technique pour l’Amelioration de la Viticulture’ (ENTAV) contracted with FPS to import a clone of Sangiovese for production in the U.S. ENTAV maintains the French national repository of accredited clones and has created an ENTAV-INRA® Authorized Clone trademark to identify its official clonal materials internationally. Trademarked importations come directly from official French source vines and all the propagation work and records are checked by the most authoritative French experts. ENTAV retains the exclusive rights to control the distribution and propagation of its trademarked materials, which are only available to the public from nurseries licensed by ENTAV (California Grapevine Nursery, Herrick Grapevines, Mercier Grapevines and Sunridge Nurseries). The Sangiovese clone sent by ENTAV was labeled Nielluccio, which is the name Sangiovese is known by on Corsica. Based on DNA analysis, Calo et. al., (2004) reported that Nielluccio should be considered one of the biotypes of Sangiovese as well as a synonym. Since privately owned clones are identified at FPS with the names chosen by the owners, this clone is designated Nielluccio ENTAV-INRA® 903. It was registered in the California R&C program in 2000.

In 1997 VCR formed a joint venture with NovaVine Grapevine Nursery in Santa Rosa, California making NovaVine the exclusive U.S. producer and distributor of privately-controlled VCR clones. As part of this project, VCR sent six private Sangiovese clones to FPS over a period of three years (1998-2000). All six clones qualified to be released from quarantine without any virus elimination treatments. The VCR sources and associated FPS selection numbers are shown below along with information about biotype designations, horticultural characteristics, and enological descriptions from Michael Jones, VCR, NovaVine, *Vitigni d’Italia*, *Catalogo dei Cloni*, and the Italian journal *Vignevini*.

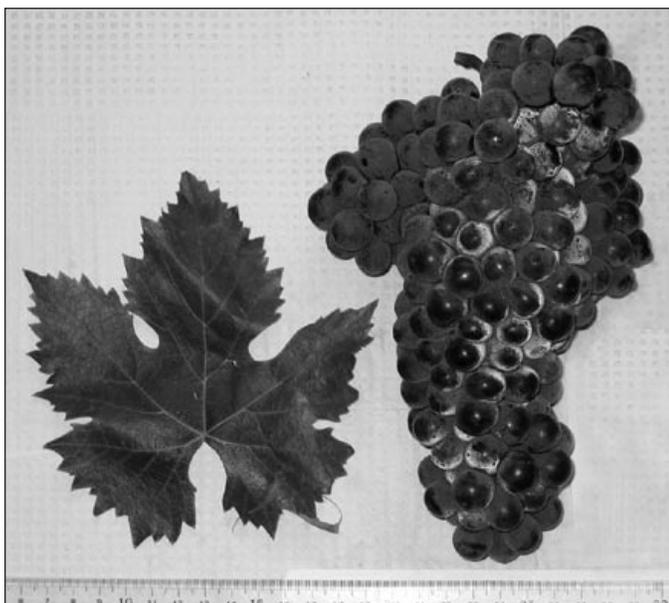
Sangiovese FPS 07 (registered in CA 2002) is from VCR 6 (Montalcino). VCR 6 is a clone of the Montalcino biotype, which is the biotype traditionally used to produce

Brunello di Montalcino wine. It has good vigor, medium productivity, good general and basal fertility, and medium-small clusters that are moderately compact. Berries are medium-small, dark blue with good botrytis resistance. The wine is rich in color, perfumed and spicy, with plum and cherry scents, robust, and improves with aging. VCR 6 and VCR 23 were the preferred stand-alone clones in microvinification tastings.

Sangiovese FPS 08 (registered CA in 2002) is from VCR 19 (Romagnolo). The vine is vigorous with medium productivity and good basal fertility. It is adapted to hilly terrain, heavy soils. The clusters are medium, semi-compact with one wing. The berries are medium-small, thick-skinned and resistant to botrytis. The wine has good color, intensity, and floral/spicy aromas. It is adapted for moderate aging and blending. This clone originally came from Emilia-Romagna.

Sangiovese FPS 10 (registered in CA in 2001) is from VCR 23 (Romagnolo). The vine has good vigor, medium productivity, medium general and basal fertility. The clusters are medium-small, cylindrical, and semi-compact. The berries are smaller than average and blue-black in color with good botrytis resistance. The wine is light ruby red with the spicy aroma of cinnamon and black pepper. It has good body and good polyphenols. It is adapted for long aging and/or blending. This clone originally came from Emilia-Romagna.

Sangiovese FPS 09 (registered in CA in 2002) is from VCR 30 (Lamole). The vine has medium vigor and production with good general and basal fertility. The clusters are medium cylindrical and semi-compact. The



Sangiovese FPS 13. Photo by JaRue Manning



Sangiovese FPS 18. Photo by JaRue Manning

berries are medium dark blue and resistant to botrytis. The wine is fruity, and spicy with good color and structure. This clone is adapted for Chianti blends and the wine acquires finesse with aging.

Sangiovese FPS 13 (registered in CA in 2004) is from VCR 102 (Prugnolo). The vine has lower than normal vigor and production capacity. It has medium fertility, good basal fertility. The clusters are medium-small and semi-compact. The berries are medium size and blue-black in color with good botrytis resistance. The wine has intense ruby red color, spicy nose and good structure. It is tannic and full bodied. It is adapted for blending with wines destined for long aging. This clone originally came from Tuscany. Prugnolo is the name for the biotype of Sangiovese grown in the Montepulciano region, and is used to produce “Vino Nobile de Montepulciano.”

Sangiovese FPS 18 (registered in CA in 2004) is from VCR 221. The clonal evaluation process was not completed for Sangiovese 221 in Italy, so no description is available at this time.

In total, FPS has 20 Sangiovese selections in the collection in 2006. Of these, seven are privately owned and controlled, while the remaining 13 are available for distribution from FPS without restriction. All of the Sangiovese selections are shown in Figure 1 with registration status and availability noted. Many of the selections of Sangiovese available from FPS and private nurseries have

Summary of the Sangiovese selections, availability and their source and disease test status.

FPS sel #	Reported Source	Reg Status	Available from FPS	Disease test status	Treatment
01	from Italy by Enrico Prati in 1940	registered 1970-1985 currently non-reg	no	leafroll+	heat treated 81 days
02	from Italy by Enrico Prati in 1940	registered 1977	yes	all tests negative	heat treated 145 days
03	PI #391453 from Italy in 1973	registered 1980-1992 currently non-reg	no	leafroll+	none
24	PI #391453 from Italy in 1974, from FPS 03	provisional 2005	yes	all tests negative	shoot tip culture
04	Rauscedo 10 from Italy 1983	registered 1997	yes HOLD	all tests negative	none
06	Italian clone FI-PI-4 from Italy in 1995	registered 2001	yes	RSP+	none
20	Italian clone FI-PI-4 from Italy in 1995	registered 2005	yes	all tests negative	shoot tip culture
19	Italian clone FI-PA-172 from Italy in 1995	registered 2005	yes	all tests negative	shoot tip culture
12	Italian clone B-BS-11 from Italy in 1995	registered 2003	yes	all tests negative	shoot tip culture
15	Atlas Peak clone from Pepi Winery in 1996	registered 2003	yes	all tests negative	shoot tip culture
05	Bionde Santi clone from Pepi Winery in 1996	registered 2001	yes	RSP+	none
14	Bionde Santi clone from Pepi Winery in 1996	registered 2003	yes	all tests negative	shoot tip culture
23	Bob Jr clone from Pepi Winery in 1996	provisional 2005	yes	all tests negative	shoot tip culture
22	Crown clone from Pepi Winery in 1996 (ID probably = Sagrantino)	provisional 2001	yes HOLD	all tests negative on hold because of mis ID	shoot tip culture
26	Alexander Valley Estancia clone from Pepi Winery in 1996	provisional 2006	fall 2006	all tests negative	shoot tip culture
17	Oakville Station clone from Pepi Winery in 1996	registered 2003	yes	all tests negative	shoot tip culture
21	Rutherford/St. Helena clone from Pepi Winery in 1996	registered 2004	yes	all tests negative	shoot tip culture
07	VCR 6, from Italy in 1998	registered 2002	contact Novavine	RSP+	none
08	VCR 19, from Italy in 1998	registered 2002	contact Novavine	RSP+	none
09	VCR 30, from Italy in 1998	registered 2002	contact Novavine	RSP+	none
10	VCR 23, from Italy in 1998	registered 2001	contact Novavine	RSP+	none
13	VCR 102, from Italy in 1999	registered 2004	contact Novavine	all tests negative	none
18	VCR 221, from Italy in 2000	registered 2004	contact Novavine	RSP+	none
Nielluccio 903	ENTAV INRA ® 903 Authorized Clone from ENTAVFrance in 1997	registered 2000	contact Sunridge	all tests to qualify for foundation stock negative	none

already been evaluated in Italy or France, but are just now becoming registered in the California R&C program. It will be interesting to see how they perform in future California vintages.

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Giovanni Mattii, Professor, Università degli Studi di Firenze, Italy

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